

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Appl. No.: 09/754,762

Applicant: Lewis et al.

Filed: January 4, 2001

Title: Method and Apparatus for
Filling Stock Orders

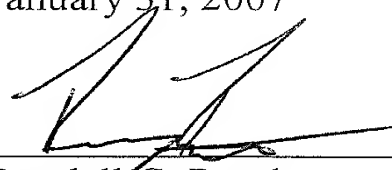
TC/A.U.: 3653

Examiner: Jeffery A. Shapiro

Att. Docket No.: 29488/36815

) I hereby certify that this paper and the
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**DECLARATION OF JIMMY RANDOLPH LEWIS AND SEAN GARY
MCGONAGLE UNDER 37 C.F.R. § 1.131**

Mail Stop Amendment
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Sir:

We, Jimmy Randolph Lewis and Sean Gary McGonagle, hereby declare the
following:

1. We are the original, joint inventors of the subject matter claimed and disclosed
in the above-captioned application.

2. We have been informed that the above-captioned application, U.S. Application
Serial No. 09/754,762 was filed January 4, 2001 ("the Application").

3. We submit this Declaration for the purpose of providing evidence that the
subject matter claimed in the Application was conceived and reduced to practice in the
United States of America as of a date prior in time to December 21, 1998.

4. We have also been informed that U.S. Patent No. 6,205,396 to Teicher (hereinafter, “Teicher” a copy of which is attached hereto as Exhibit “A”) was cited against the claims pending in the Application.

5. We have been informed that the effective date of Teicher as an alleged prior art reference is December 21, 1998.

6. We have read and understood Teicher, attached as Exhibit A.

7. To establish the conception date of our invention prior to December 21, 1998, we provide evidence in the form of drawings, inventors’ notes, and internal proposals (copies of which are attached hereto as Exhibits “B” through “E”) which describe facts relating to each and every element of claims 7, 8, 10-19, and 21-28 as required by MPEP 715.07 to satisfy 37 C.F.R. §1.131. The exhibits describe the invention of the above-noted patent application, and specifically include a description of a method and apparatus for filing stock orders. In particular, the exhibits describe a method and apparatus of filing stock orders in a “pick to light” system that includes at least one number display for showing a desired quantity of each stock item; at least one container display for showing a unique container identifier associated with a selected container into which each stock item is to be placed, wherein each container is assigned a unique identifier; at least two location indicators associated with the storage bins, a first location indicator comprising a light associated with each storage bin, and a second location indicator comprising a direction display; and a computer operably coupled to the lights, the at least one number display, the at least one container display, and the direction display, wherein the computer receives the orders for the stock items and assigns a selected container to each stock item, directs the at least one number display to show the desired quantity of the stock item in a current pick operation, directs the at least one container display to show the unique container identifier associated with the selected container assigned to the current pick operation, illuminates the light for the

storage bin associated with the specific stock item in the current pick operation, and operates the direction display to indicate a direction of a storage bin associated with a subsequent pick operation.

8. To establish a date of constructive reduction to practice of our invention prior to December 21, 1998, in Exhibit B we provide notes dated April 10, 1996 that were written by Sean McGonagle indicating the problems associated with previous systems to include pickers “hav[ing] to turn around” during the pick process and that the “pickers can’t pick ahead of each other” (Exhibit B, page 1, “Picking”). Further, in the front-view illustration of the “Human A-Frame” we clearly designate “Lite Strips” and a “Bay Controller” to indicate a light associated with each bin and a computer operably connected to the lights (Exhibit B, page 4, “Picking”) to convey directional information.

9. In Exhibit C, we provide a document entitled “Pick to Bucket Design Criteria” that we provided to vendors during the testing phase of invention development. In the document, we refer to a “Pick to Light System to put the product into a hopper indicated by a light that contains the picks...” (Exhibit C, Page 1, “General Description”). Further, we discuss “hoppers” that “provide an area for mounting the Walgreens Pick to Light system (PTL).” (Exhibit C, Page 1, “Functional Requirements”). We also disclose a “Control System” that, among other things, “provide[s] an indication to the picker via pick to light” and assign[s] a section of belt” to an order of hoppers. (Exhibit C, Page 1, “Control System”).

10. Further, we provide a document entitled “Pick-To-Bucket Order Processing System Proposal” in Exhibit D. On a date prior to June 30, 1999, we submitted Exhibit C “Pick to Bucket Design Criteria” to SI Handling Systems of Easton, Pennsylvania. Working with our input, SI Handling Systems developed the proposal dated June 30, 1999. As a result of our direct input and the submitted design criteria of Exhibit C, the system disclosed in

Exhibit D includes a “[p]ick-to-light” feature with “[p]ick bucket indicator lights and acknowledgment buttons” (Exhibit D, page 2, section 1.3, “Walgreens Responsibilities”).

Also, the proposal describes that “items are placed into a bucket indicated by a light” to reference a light associated with each bin (Exhibit D, page 2, section 3.0, “System Description”). The proposal further describes computers as a “PTB control system” and a “BRTS Control System” operably coupled to the lights (Exhibit D, page 2, section 3.0, “System Description” and page 4, section 5.0 “BRTS Control System”).

11. Also, notes describing our invention and its pick-to-light features are provided as Exhibit D. In handwritten notes dated April 11, 2000, we describe a “PTL [Pick-to-Light] to direct picker” that reduces or eliminates “time lag for recognition” (Exhibit D, page 1, “Walgreens Claims”). The notes also include a “Pick Arrow Indicator” that “directs [a] pick[er] to [the] correct area of [the] pick” and a “Display Bin (Tray) location on [the] rack” that allows the “picker [to] know when they turn where pick will be...” (Exhibit D, page 1, “Walgreens Claims”).

12. By proposing and developing a pick-to-light system to include the elements discussed above and disclosed in Exhibits B, C, D, and E, we concluded, prior to December 21, 1998, that we conceived and constructively reduced to practice at least the inventions recited in the pending claims, thereby satisfying the object of the present application as evidence of reduction to practice.


13. We created the notes, drawings, and proposals in the United States of America, where our invention was also conceived, prior to December 21, 1998. We support this assertion with the attached notes dated April 10, 1996 that describe at least the problems associated with conventional pick-to-light systems and the advantages of a “Flow Rack and Shelving” system including “Lite Strips” and a “Bay Controller” to convey directional information. We also support this assertion with the attached Exhibit D dated June 30, 1999

showing a "Pick-To-Bucket Order Processing System Proposal" that resulted from our submission of Exhibit C "Pick to Bucket Design Criteria." Further, we support this assertion with our handwritten notes dated April 11, 2000 describing at least the "Pick Arrow Indicator.

14. All statements made herein of our own knowledge are true and all statements made on information and belief are believed to be true; and further these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and such willful false statements may jeopardize the validity of the application or patent issued thereon.

1/25/07
Date

1-22-07
Date


Jimmy Randolph Lewis

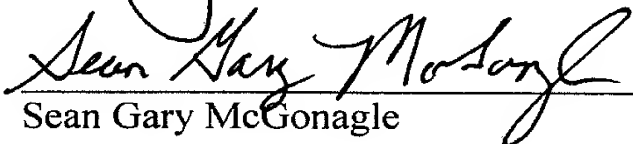

Sean Gary McGonagle

EXHIBIT A



US006205396B1

(12) **United States Patent**
Teicher et al.

(10) Patent No.: **US 6,205,396 B1**
(45) Date of Patent: **Mar. 20, 2001**

(54) **GUIDANCE SYSTEM USING CHANGEABLE SIGNS**

(75) Inventors: **Mordechai Teicher, Kfar Saba; Avner Halperin, Tel Aviv, both of (IL)**

(73) Assignee: **Eldat Communications Ltd., Bnei Brak (IL)**

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **09/147,422**

(22) PCT Filed: **Jun. 15, 1997**

(86) PCT No.: **PCT/IL97/00192**

§ 371 Date: **Dec. 21, 1998**

§ 102(e) Date: **Dec. 21, 1998**

(87) PCT Pub. No.: **WO98/00819**

PCT Pub. Date: **Jan. 8, 1998**

(30) **Foreign Application Priority Data**

Jun. 19, 1996 (IL) 118686

(51) Int. Cl.⁷ **G08G 1/123**

(52) U.S. Cl. **701/200; 701/207; 342/357.07**

(58) Field of Search **701/200, 207; 340/825.36, 825.49, 825.54; 342/357.01, 357.07, 357.1; 705/41**

(56) **References Cited**

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Pick-to-Light Directs Productivity : however you store materials, PTL indicators make for timely and accurate orderpicking by Schwind, Gene F., Material Handling Engineering, Dec 1993, pp. 1-4.

* cited by examiner

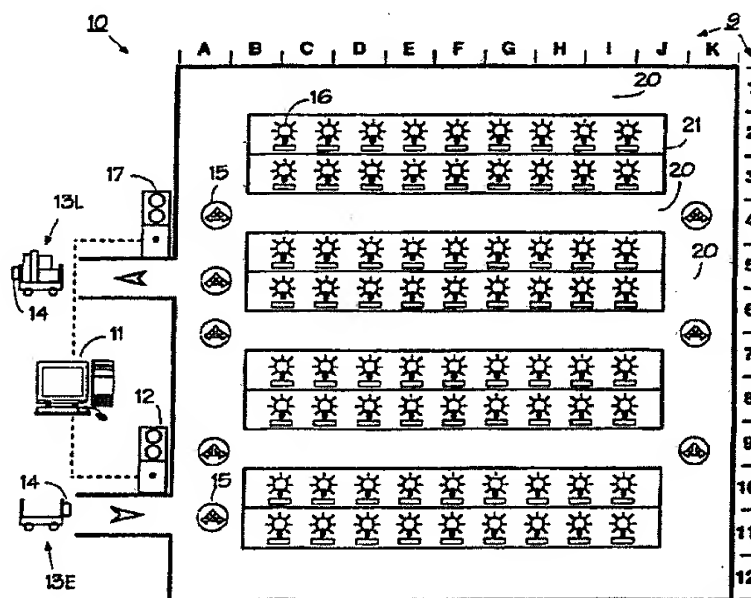
Primary Examiner—Tan Nguyen

(74) Attorney, Agent, or Firm—Eitan, Pearl, Latzer & Cohen-Zedek

(57) **ABSTRACT**

A guidance system for guiding a user to selected targets located within a defined area, such as a warehouse, museum, parking garage, etc., includes a portable unit to be carried by each user and having a memory for storing target information identifying a selected target within the defined area, and a transmitter for transmitting signals identifying the selected target within the defined area. The system further includes at least one changeable guidance sign at a predetermined location within the defined area for receiving signals transmitted by a portable unit and for displaying stored guidance information of the location of a target corresponding to a signal transmitted from the portable unit, and/or a plurality of target devices at the target location for receiving target signals transmitting by a portable unit and for indicating that a received target signal identifies the respective target.

20 Claims, 9 Drawing Sheets



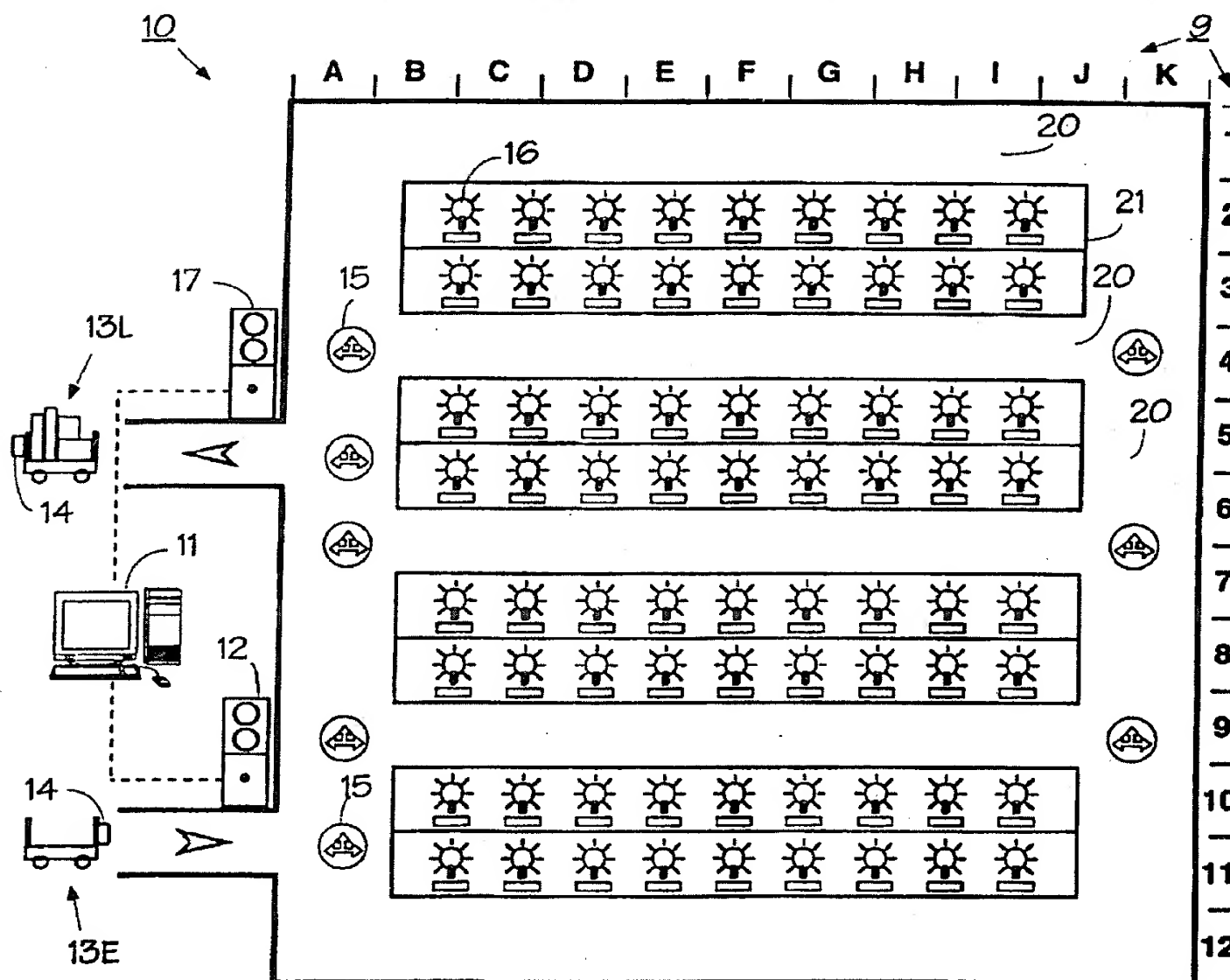


FIG. 1

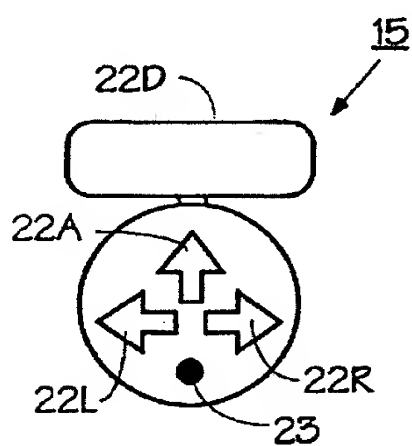


FIG. 2A

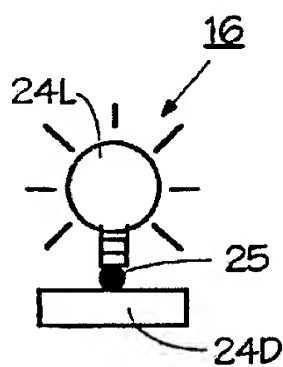


FIG. 2B

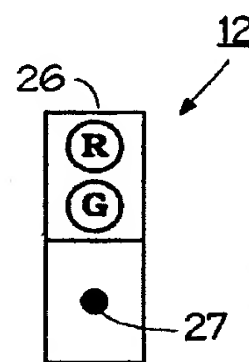


FIG. 2C

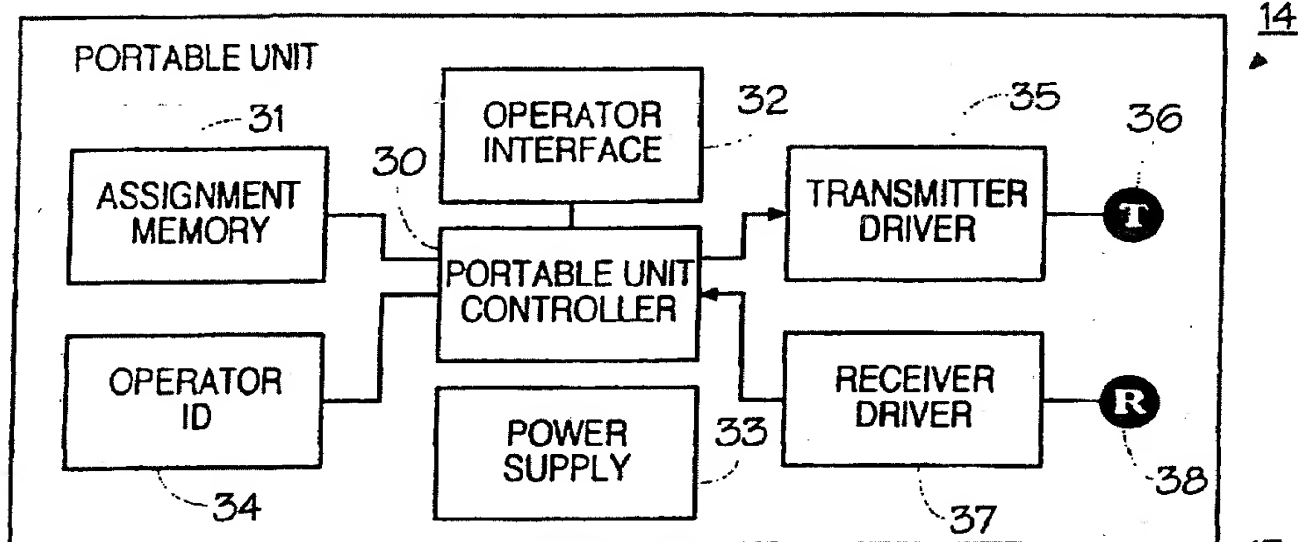


FIG. 3

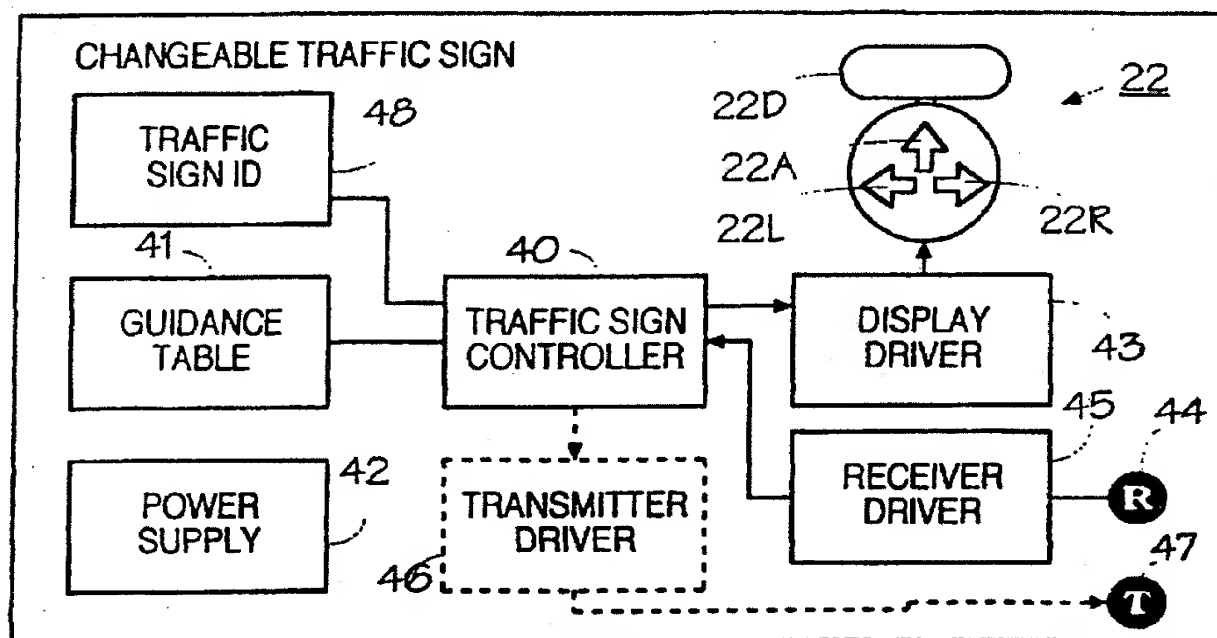


FIG. 4

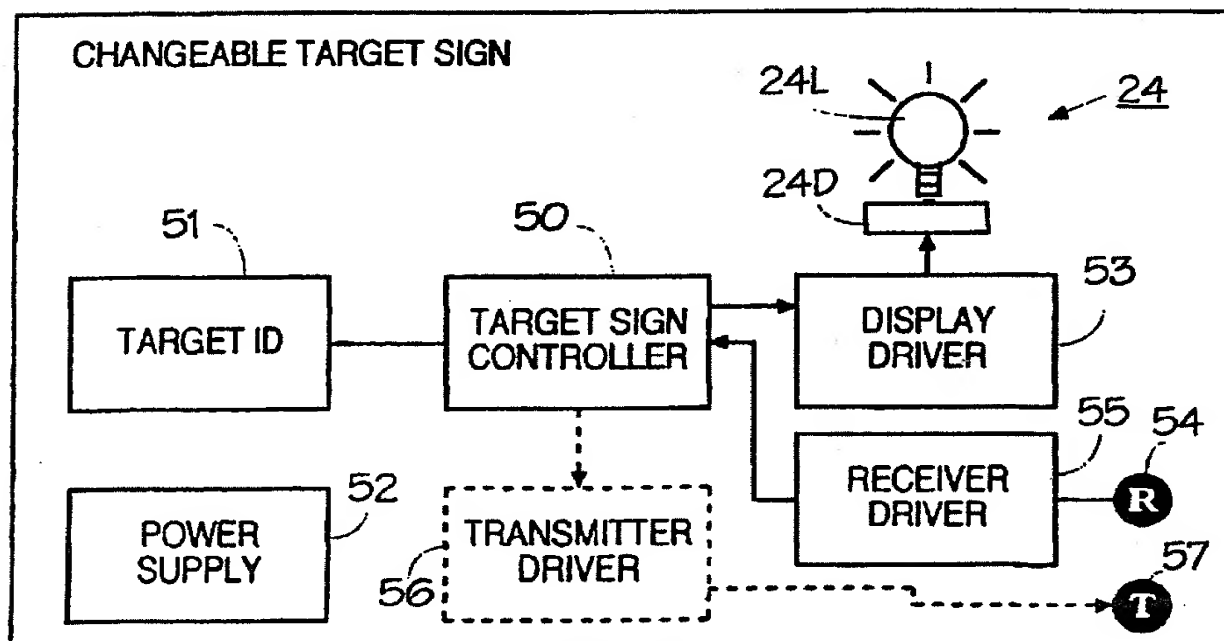


FIG. 5

ASSIGNMENT MEMORY

	<u>TARGET LOCATION</u>	<u>TARGET ID</u>	<u>ASSIGNMENT DETAILS</u>	<u>REPORT</u>
1.	E6	1234	PICK 4 BOXES	[_____]
2.	H3	4321	PICK 2 UNITS	[_____]
3.	D1	3412	PICK 2 UNITS & EXIT	[_____]

FIG. 6A

GUIDANCE TABLE

<u>LOCATION</u>	<u>DIRECTION</u>
A1	LEFT
A2	LEFT
...	...

FIG. 6B

GUIDANCE SIGNAL

[TARGET LOCATION]
[TARGET ID]
[ASSIGNMENT DETAILS]
[OPERATOR ID]

FIG. 6C

ASSIGNMENT MEMORY

	<u>ROUTE DIRECTIONS</u>	<u>TARGET ID</u>	<u>ASSIGNMENT DETAILS</u>	<u>REPORT</u>
1.	1-L;3-R;6-A;8-R;	1234	PICK 4 BOXES	[_____]
2.	10-L;14-L;15-R;	4321	PICK 2 UNITS	[_____]
3.	21-R;22-L;	3412	PICK 2 UNITS & EXIT	[_____]

FIG. 7A

GUIDANCE TABLE

SIGN#=12

FIG. 7B

GUIDANCE SIGNAL

[OPERATOR ID]
["SIGN#-DIRECTION" OR
"TARGET ID-ASSIGNMENT"]

FIG. 7C

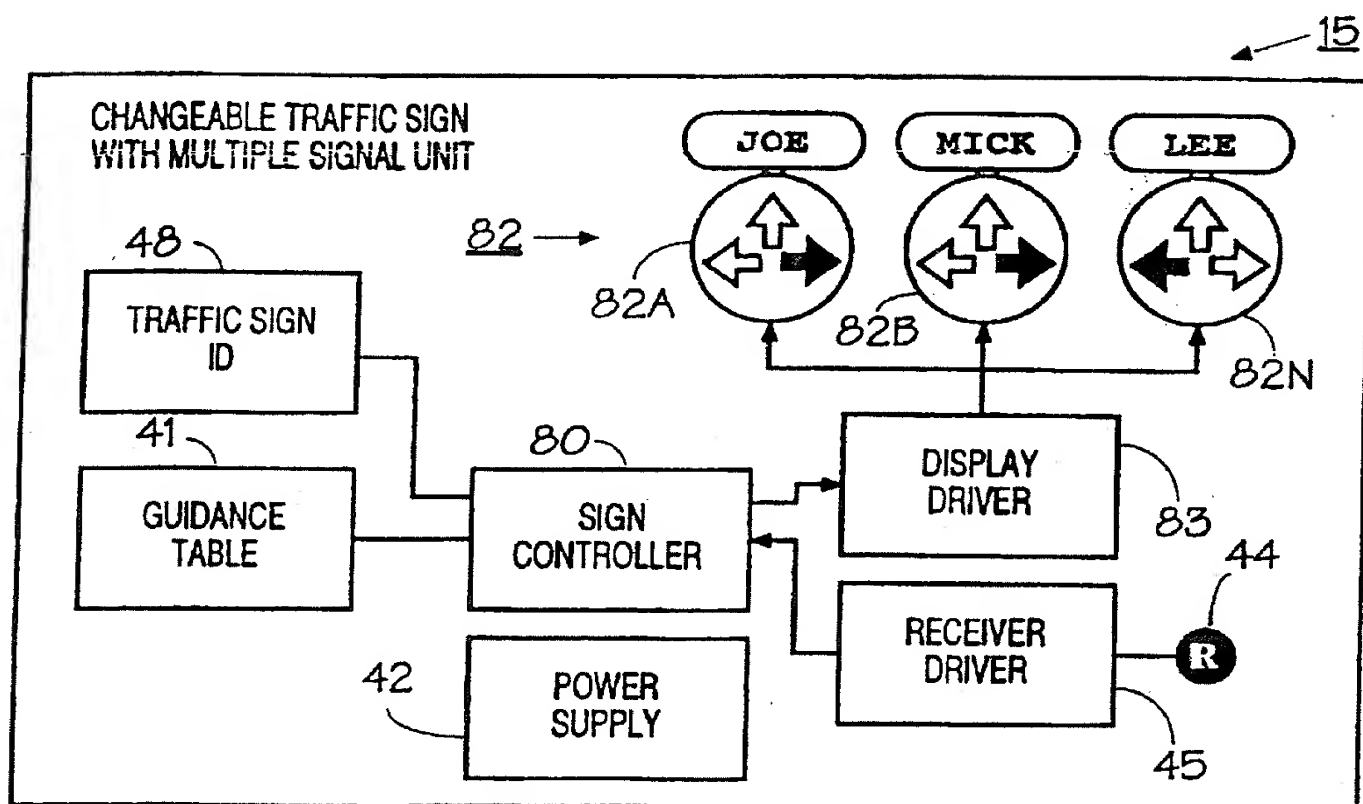


FIG. 8

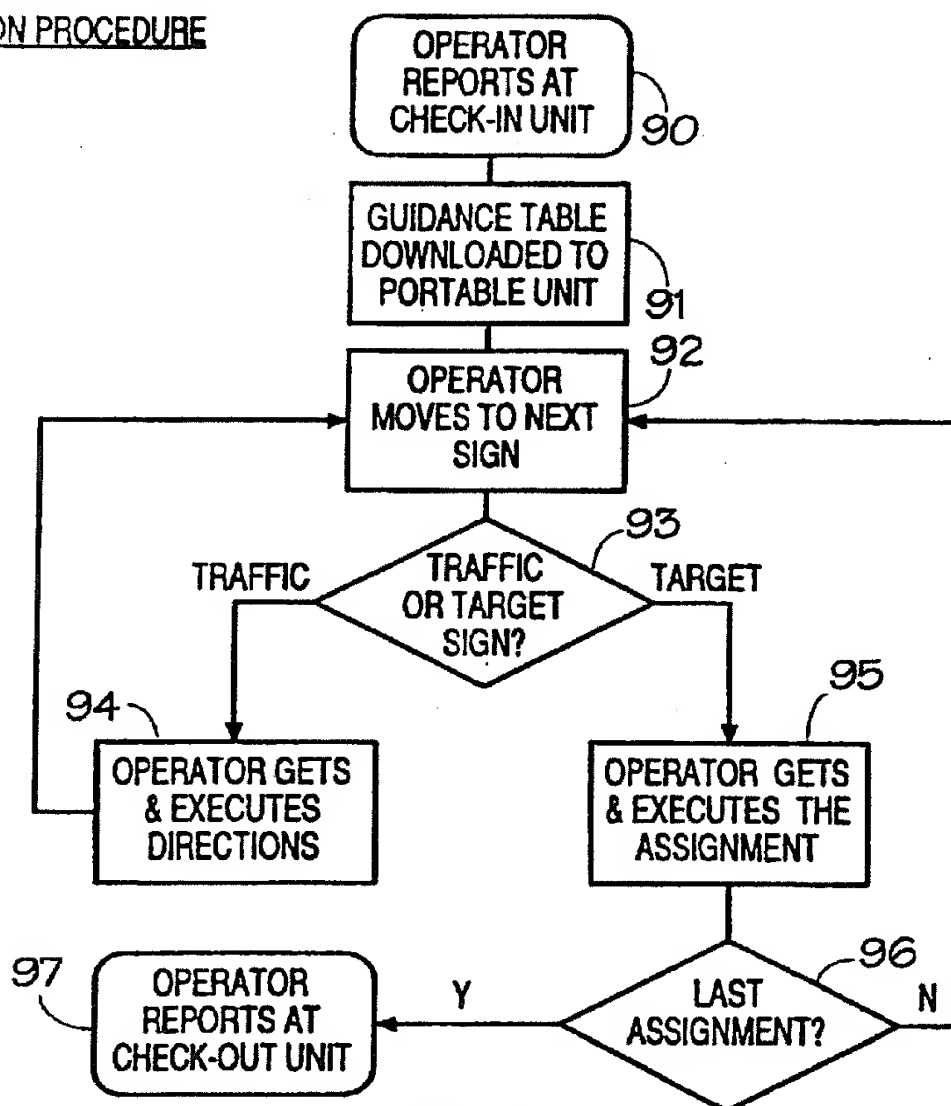
OPERATION PROCEDURE

FIG. 9

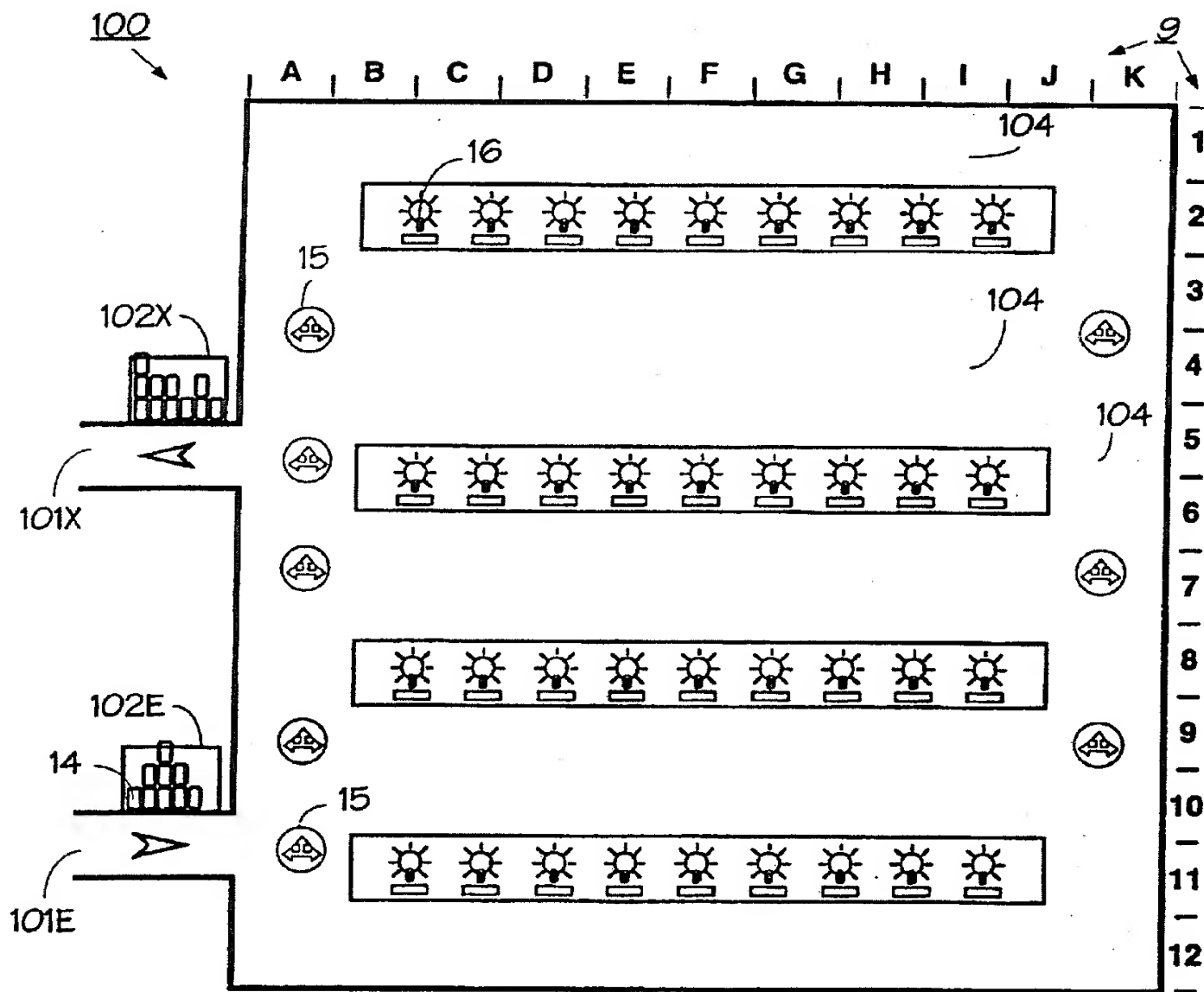
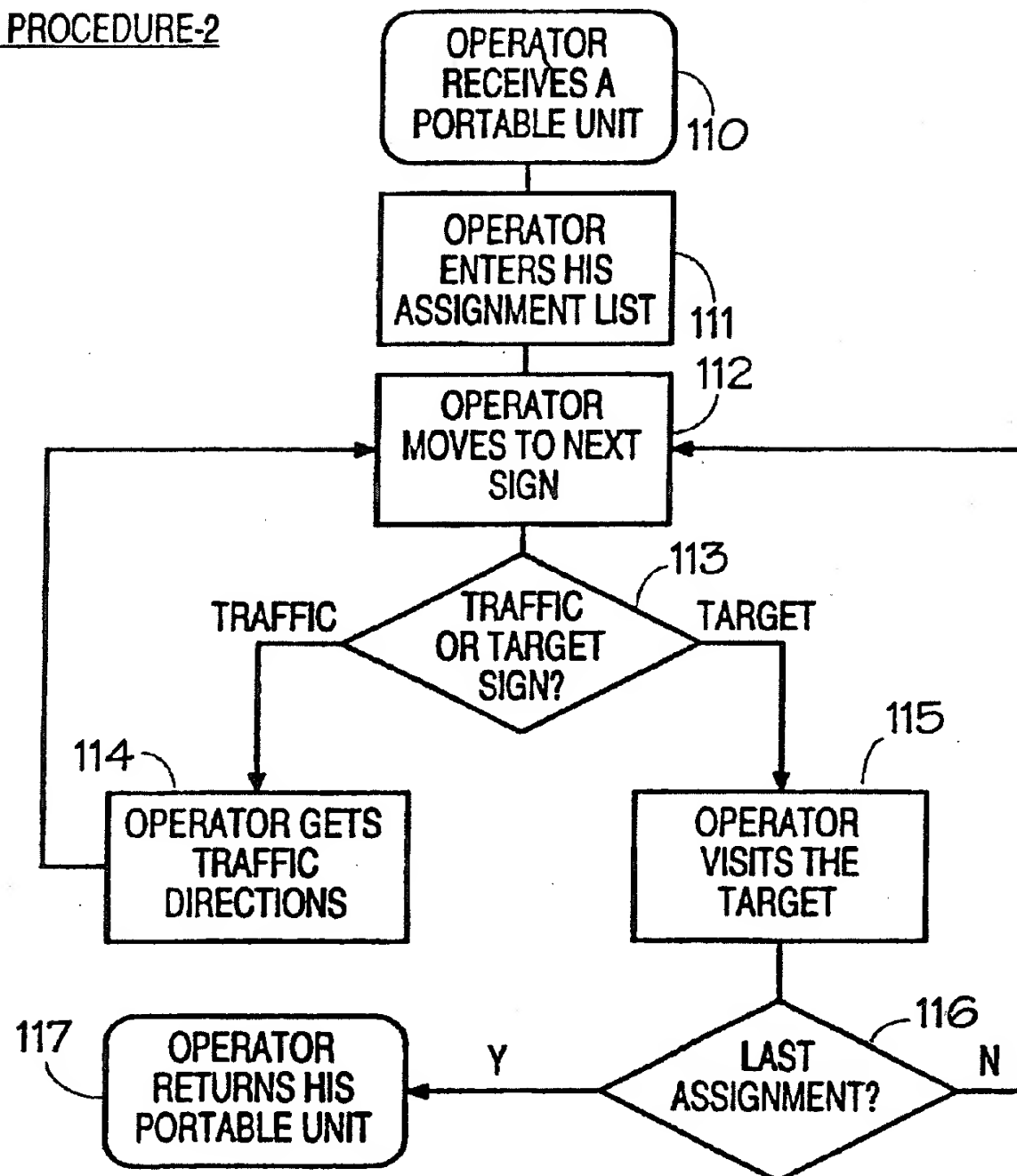


FIG. 10

OPERATION PROCEDURE-2**FIG. 11**

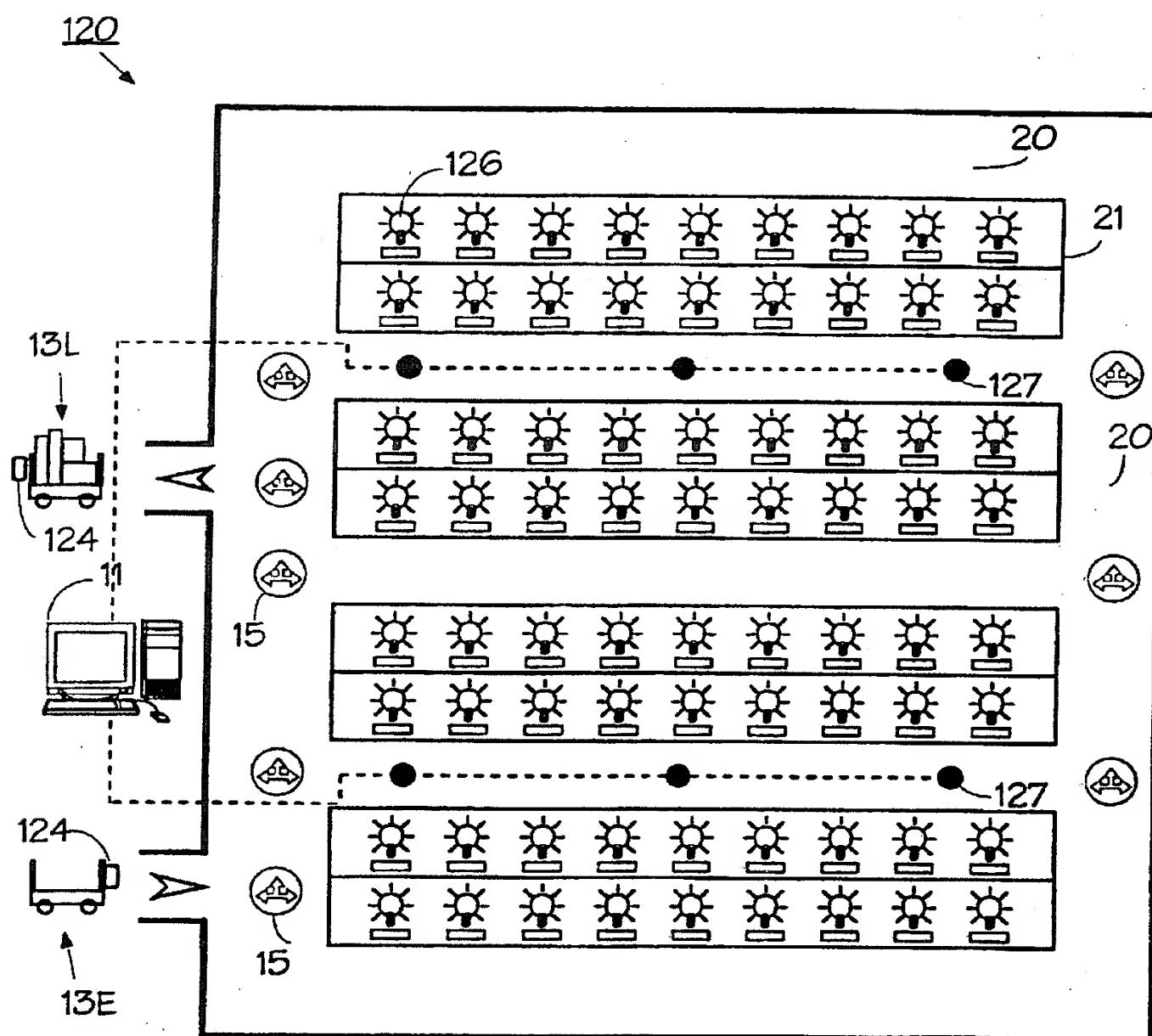


FIG. 12

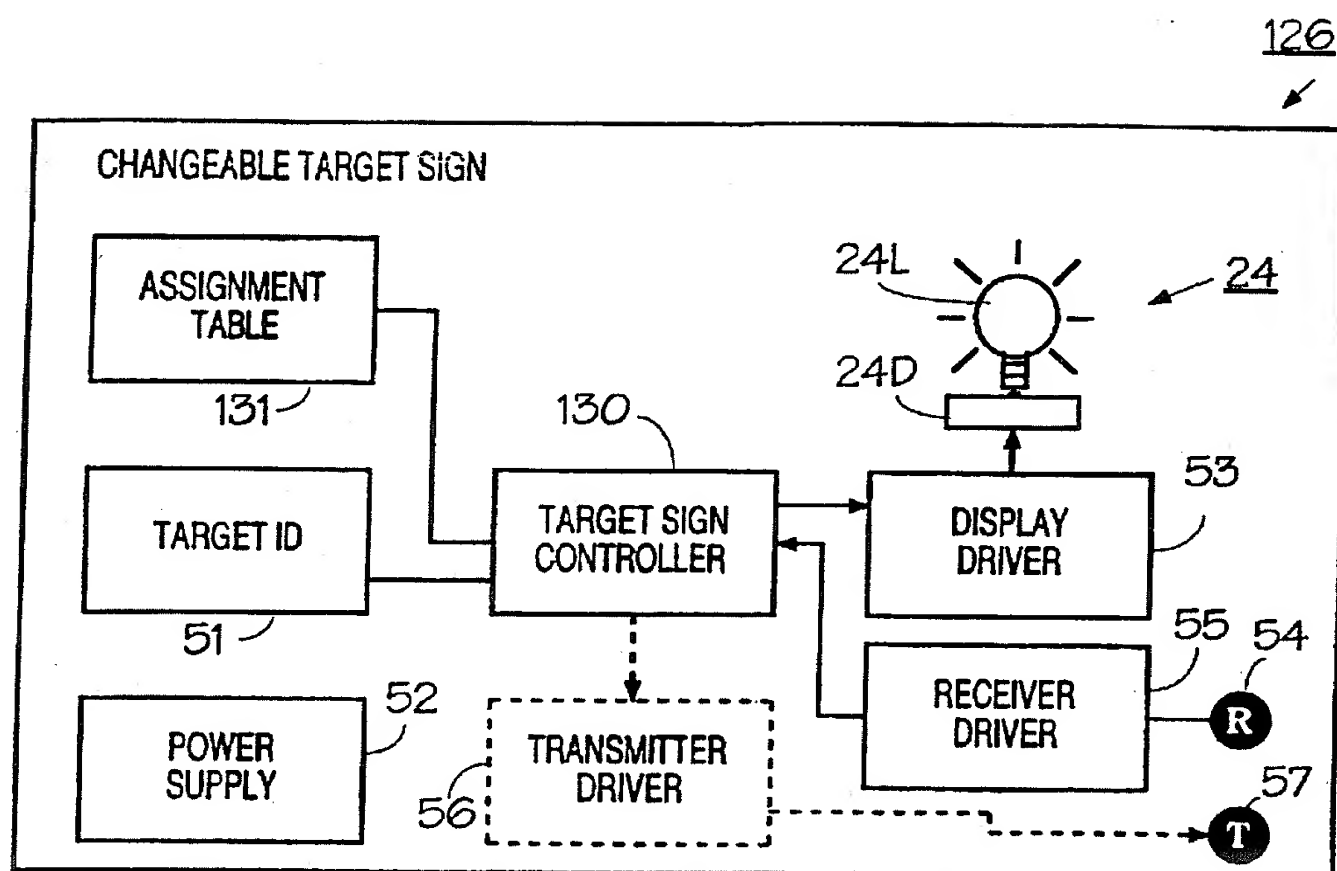


FIG. 13

ASSIGNMENT MEMORY

	TARGET ID	REPORT
1.	1234	[_____]
2.	4321	[_____]
3.	3412	[_____]

FIG. 14A

GUIDANCE TABLE

TARGET ID	DIRECTION
1234	LEFT
4321	LEFT
...	...

FIG. 14B

GUIDANCE SIGNAL

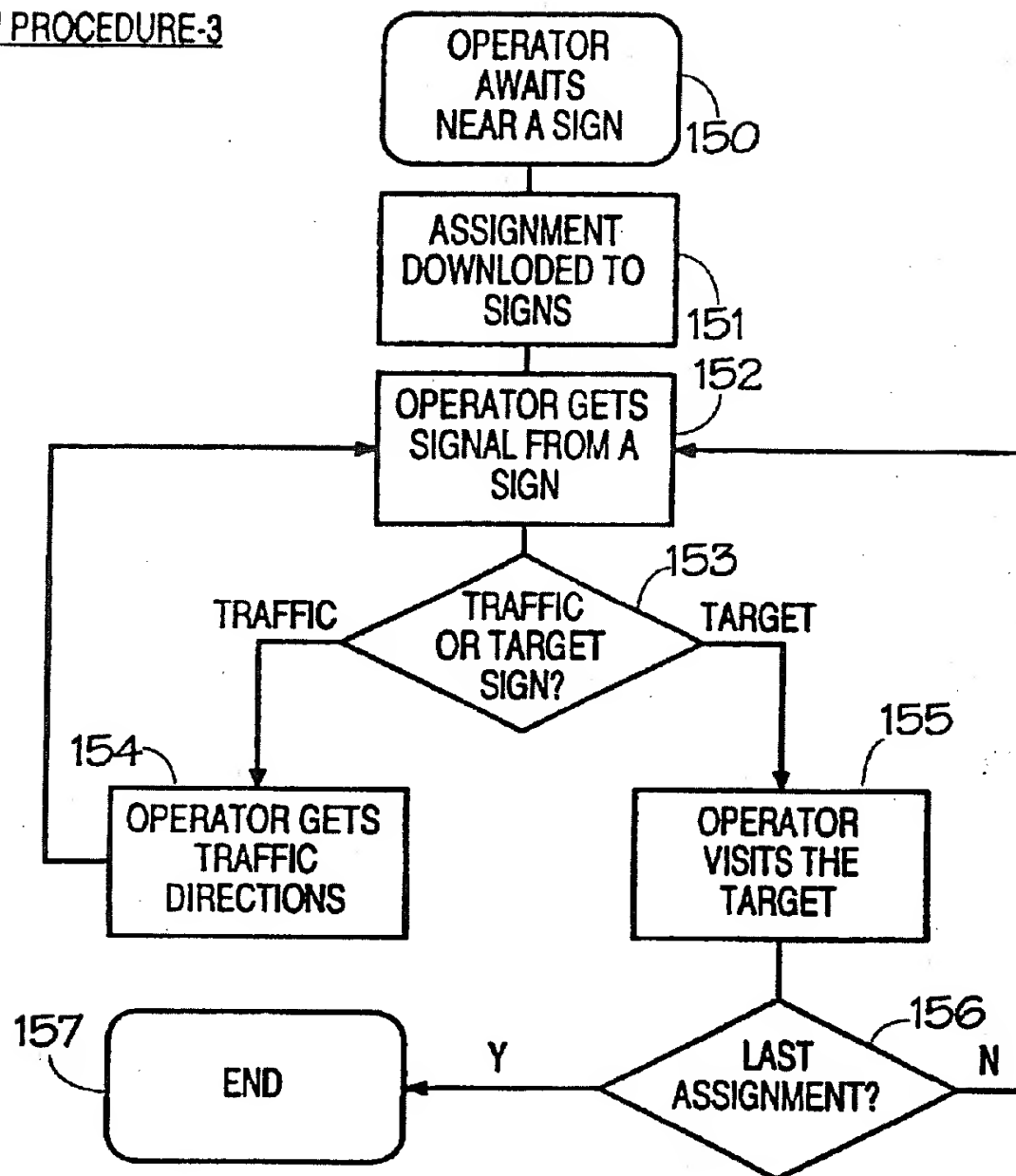
[TARGET ID]
[OPERATOR ID]

FIG. 14C

ASSIGNMENT TABLE

	OPERATOR ID	ASSIGNMENT DETAILS
1.	ABE	PICK 4 BOXES
2.	HARRY	PICK 2 UNITS
3.	JIM	PICK 2 UNITS & EXIT

FIG. 14D

OPERATION PROCEDURE-3**FIG. 15**

GUIDANCE SYSTEM USING CHANGEABLE SIGNS

FIELD AND BACKGROUND OF THE INVENTION

The present invention relates to guidance systems and in particular to such systems using changeable signs to lead a person to a predefined target.

Many human activities involve the need to reach a predefined location or object. Guidance means for choosing a preferred route or for identifying the target location or object are in common use, usually in the form of signs. Such signs, clearly visible from a fair distance, allow a person to choose the route to the target without interrupting the travel or risking travel safety. However, when the number of possible routes or targets is large, the use of common signs becomes impractical, because too much visual information must be displayed and then read and interpreted during travel. A changeable sign system capable of providing selectively guidance signals relating to a specific route or target of an individual, could be highly advantageous in such circumstances.

An example of an existing environment using changeable signs displaying route and target information is the so-called pick-to-light (PTL) system for warehouses. Such commercial systems and their advantages are described in the article "Pick-to-light directs productivity: however you store materials, PTL indicators make for timely and accurate orderpicking" by Schwind, Gene F., Material Handling Engineering, Dec. 1993, Page 43, downloaded through Compuserve Information Services. In such pick-to-light systems, the pick assignments are stored in a central computer. The central computer communicates with terminals positioned next to stock locations. When a certain pick assignment is activated by the central computer, lights in the corresponding terminals are turned on to provide the picker with clear visual guidance signals. Additional information may be generated by the central computer and displayed by the terminal, such as information relating to the pick quantity. The terminal may also include input means for keying-in and uploading pick reports. Other prior art references relating to pick-to-light systems include U.S. Pat. Nos. 3,739,339 to Hilihouse et al., 3,908,800 to Drapeau and 4,346,453 to Drapeau et al.

While having many advantages regarding productivity and accuracy, the existing pick-to-light systems have two major limitations: they can serve only a single picker or a small number of pickers operating simultaneously, and they require a costly communication infrastructure between the central computer and all terminals.

OBJECT AND BRIEF SUMMARY OF THE INVENTION

The following terms will be used herein as follows:

1. Assignment—a task to be performed including traveling toward and reaching a target location.
2. Operator—a human individual executing an assignment while traveling by foot or by a vehicle.
3. Guidance—the information provided to an operator for aiding in choosing a preferred route and/or in identifying the target location or item.
4. Sign—an object positioned next to traffic routes or target locations for displaying guidance information viewable by an operator from a fair distance and usable by operator without interrupting travel. Signs may incorporate lights and symbols for visibility and clarity.

5. Changeable sign—a sign which changes the information displayed thereon upon receiving an external signal.

6. Central computer—a computer storing assignment information.

The main object of the present invention is to provide a guidance system using changeable signs, which system can serve simultaneously a large number of operators and does not require a central computer, or a communication link between a central computer and the signs. Another object of the present invention is to provide an assignment reporting system operable in conjunction with said guidance system.

According to one aspect of the present invention, there is provided a guidance system for guiding a user to selected targets among a plurality of targets located within a defined area, comprising:

a portable unit to be carried by the user, including a memory for storing target information identifying a selected target within said defined area, and a transmitter for signals identifying the selected target within said defined area;

and at least one changeable guidance sign at a predetermined location within said defined area, said changeable guidance sign including a receiver for receiving signals transmitted by said portable unit, a memory for storing guidance information relating to the locations of said plurality of targets with respect to said predetermined location of the changeable guidance sign, a display for displaying the stored guidance information of the location of a target corresponding to a signal transmitted from said portable unit and received by the changeable guidance sign.

According to another aspect of the present invention, there is provided a guiding system for guiding a user to selected targets among a plurality of targets located within a defined area, comprising:

a portable unit to be carried by the user, including a memory for storing target information identifying a selected target within said defined area, and a transmitter for transmitting signals identifying the selected target within said defined area;

a plurality of target devices, one at each of said target locations, each of said target devices including a receiver for receiving target signals transmitted by said portable unit, and a target indicator for indicating that a received target signal identifies the respective target;

and a computer for storing said target data identifying the targets within said defined area, and for communicating with said portable unit to download into their respective memories the target information identifying selected targets within said defined area.

A number of applications of the invention are described for purposes of example, including a warehouse for storing a large number of articles, a museum having a large number of exhibits, and a parking garage having a large number of parking spaces.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a schematic illustration of a layout of a guidance system according to the present invention.

FIGS. 2A–C are schematic illustrations of the signs in the system of FIG. 1.

FIG. 3 is a schematic block diagram of a portable unit according to the present invention.

FIG. 4 is a schematic block diagram of a changeable traffic sign according to the present invention.

FIG. 5 is a schematic block diagram of a changeable target sign according to the present invention.

FIGS. 6A–C are examples of data structures maintained in and communicated between various components of the present invention.

FIGS. 7A-C are examples of alternative data structures maintained in and communicated between various components of the present invention.

FIG. 8 is a schematic block diagram of a changeable traffic sign with a multiple signal unit.

FIG. 9 is a flowchart describing the operation of the present invention.

FIG. 10 is a schematic illustration of a layout of another variation of the guidance system according to the present invention.

FIG. 11 is a flowchart describing the operation of the variation of FIG. 10.

FIG. 12 is a schematic illustration of an alternative layout of a variation of the guidance system according to the present invention.

FIG. 13 is a block diagram of a changeable target sign adapted to the variation of FIG. 12.

FIGS. 14A-D illustrate the data in the assignment memory, guidance table, guidance signal and assignment table, according to the variation of FIG. 12.

FIG. 15 is a flowchart describing the operation of the variation of FIG. 12.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Reference is now made to FIGS. 1 and 2A-C illustrating a layout of a preferred embodiment of the present invention, where the guidance system of the present invention is used to aid operators in executing pick assignments in a warehouse.

Warehouse 10 accommodates grouped merchandise items (not shown) on shelves 21. Passageways 20 allow access to the merchandise items. At each junction formed by the passageways there is provided a changeable traffic sign 15. A changeable target sign 16 is positioned next to each group of identical merchandise items. The entire area is divided into cells by coordinates 9, to allow coarse location identification by coordinates such as B5, H11 etc. It would be appreciated that such coarse identification of locations can alternatively use room numbers, aisle numbers or other symbols; and the term "coordinates" should be interpreted hereinafter in its broader sense, as symbols coarsely identifying localities within the operational area.

An operator, using empty cart 13E and a portable unit 14 attached to the cart, reports at a check-in unit 12. Upon identifying the operator, central computer 11 allocates an assignment for the operator and downloads it to portable unit 14 through check-in unit 12. Upon receiving a "Green" light from traffic light 26 of the check-in unit (FIG. 2C), which confirms the successful download of the assignment information, the operator enters the first junction. By communicating with the changeable traffic sign 15, the portable unit 14 transmits thereto traffic information signals, transformed thereon into visible traffic directions. When arriving to a line of sight with the target destination, as identified by the target sign ID transmitted by the portable unit 14, the respective target sign 16 responds with a visible signal, identifying the adjacent target location. The operator may use an optional operator interface 32 on portable unit 14 (FIG. 3) to enter assignment report information into the portable unit, such as the extent of the assignment completion. After the assignment completion, the operator moves to the next traffic sign 15, where he receives directions which lead him either to the next assignment, or toward the checkout unit 17, where portable unit 14 uploads assignment

report information, and then the loaded cart 13L has completed its loading assignment.

FIG. 2A illustrates (the appearance of) a changeable traffic sign 15. Infrared receiver (or transceiver, according to the selected embodiment) 23 is operative to communicate with portable unit 14. Light arrows 22A, 22L and 22R are actuated to guide the operator to move ahead, to the left or to the right, respectively. Alphanumeric sign 22D displays information identifying the operator or the assignment.

FIG. 2B illustrates a target sign 16. Infrared receiver (or transceiver, according to the selected embodiment) 25 is operative to communicate with portable unit 14. Light 24L signals to identify the selected target, and alphanumeric display 24D operates to display the operators ID and assignment information, e.g. the quantity of items to be picked.

FIG. 2C illustrates a terminal unit functioning as a check-in unit 12 (or as a checkout unit 17). The terminal unit communicates with portable unit 14 through IR transceiver 27. Red-Green lights 26 provide the operator with visible indication whether the upload/download of information from/to the portable unit has been completed.

Reference is now made to FIG. 3 which is a block diagram of portable unit 14. Portable unit controller 30 controls the operation of the unit. Operator ID register 34 includes the operators name or code, which is preloaded during the units initialization, and is used to identify the operator when uploading or downloading assignment information, and when communicating with traffic and target signs to identify the operators identity thereon. Operator interface 32, e.g. a keyboard and LCD display, is used to key-in the operator's ID, to be stored in register 34, and assignment report information, to be stored in assignment memory 31. Assignment memory 31 contains assignment information downloaded from computer 11 through check-in unit 12, and report information keyed-in through operator interface 32.

Infrared transmitter 36 and receiver 38, driven through drivers 35 and 37, respectively, are operative to communicate with traffic signs 15, target signs 16, check-in units 12 and check-out units 17. Power supply 33 energizes all other parts of the portable unit 14.

FIG. 4 is a block diagram of the changeable traffic sign 15 of FIG. 1. controller 40 controls all the operations of the sign. Guidance table 41 includes preloaded information useful for guiding the operator, as will be described in relation to FIGS. 6B and 7B below. Traffic display 22, driven through driver 43, shows visual guidance signals as described in relation to FIG. 2A. The visual guidance signals are displayed for a predetermined delay after the actuating signal, received from portable unit 14, ceases. Receiver 44, driven through driver 45, is operative to receive signals from portable units 14. Transmitter 47 and driver 46 are optional for transmitting signals to portable units 14, if the embodiment of FIGS. 7A-C is selected. Power supply 42 energizes the other parts of the changeable traffic sign.

FIG. 5 is a block diagram of the changeable target sign 16 of FIG. 1. Controller 50 controls all the operations of the sign. Target ID register 51 includes preloaded target ID information identifying the target, e.g. the code of the adjacent items identified by the sign. Target display 24, driven through driver 53, shows visual signals as described in relation to FIG. 2B. The visual signals are displayed for a predetermined delay after the actuating signal, received from portable unit 14, ceases. Receiver 54, driven through driver 55, is operative to receive signals from portable units 14. Transmitter 57 and driver 56 are optional for transmitting signals to portable units 14, if the embodiment of FIGS.

5

7A-C is selected. Power supply 52 energizes the other parts of the changeable target sign.

FIGS. 6A-C and 7A-C relate to two preferred embodiments of the data distribution between the portable unit and the changeable signs. The embodiment of FIGS. 6A-C simplifies the portable unit and allows receive-only operation of the changeable traffic signs 15. The embodiment of FIGS. 7A-C simplifies the data stored in the changeable traffic signs, but requires more complicated data in the portable units as well as receive-transmit capability at the changeable traffic signs 15.

FIG. 6A illustrates the data stored in the assignment memory 31 of portable unit 14 in FIG. 3, according to a first preferred embodiment. Each line describes a separate assignment. Each assignment is described by its target location coordinates (9 of FIG. 1), the ID of the target, corresponding to the content of the respective target ID register 51 (FIG. 5), and the assignment details. Memory space is reserved for report information for each assignment, to be keyed-in, upon assignment completion, through operator interface 32 (FIG. 3). FIG. 6B describes the contents of the guidance table 41 of FIG. 4 in said first preferred embodiment. Each traffic sign 15 includes a specific, preloaded table which contains directions to each possible coordinate designation. Thus, in the example of FIG. 6B, coordinate A1 (see 9 in FIG. 1) corresponds to the direction "LEFT", i.e. in order to reach the location A1, the operator should turn left at this specific sign. Other coordinates in the table may match directions such as "AHEAD" or "RIGHT" according to their actual physical location. Obviously, different signs will include different tables, according to their physical location. The table for each sign can be prepared manually or by using computer assistance. FIG. 6C relates to the same first preferred embodiment, describing the guidance signal transmitted continuously by portable unit 14 through transmitter 36 (FIG. 3). The guidance signal includes the target location, the target ID and the target details (all from FIG. 6A), and the operator ID (from register 34 of FIG. 3). When this guidance signal is received by a traffic sign (FIG. 2A) the sign displays the traffic direction according to the guidance table of FIG. 6B, and also shows the operator's ID, to avoid ambiguity among neighboring operators. When the signal is received by a target sign (FIG. 2B), the sign examines the signal's "target ID" contents, and if there is a match, the sign provides an eye-catching, visible signal and displays the operator ID and assignment details.

It would be appreciated that addressing (in FIG. 6A) each target by both its coordinates and target ID code is just a matter of practical considerations. In an application such as a warehouse, there are two advantages to this approach: (a) locations in a warehouse accommodating 20,000 items may still be coarsely identified by, say, 100 coordinate symbols (A1-J10), sufficient for navigation among the changeable traffic signs, which will reduce the size of and simplify the guidance table included in each traffic sign; (b) items in the warehouse may be moved from time to time to different locations; the target sign will then be moved with the corresponding items, the central computer will be updated to associate the moved items with their new location coordinates, but no change will be required in the memories of the traffic and target signs. In other applications, however, where targets are fixed in their location, FIG. 6A may be modified by eliminating the "Target Location" column, in FIG. 6B the "Location" column will be replaced by "Target ID" column for specifying the directions from each sign to each target ID, and in FIG. 6C the "Target Location" data will be eliminated from the guidance signal.

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FIG. 7A illustrates the data stored in the assignment memory 31 of portable unit 14 in FIG. 3, according to a second preferred embodiment. Each line describes a separate assignment. Each assignment is described by its entire route to the target location, the ID of the target, and the assignment details. The route is defined by a series of consecutive traffic signs and the directions preassigned for each such sign; for example, assignment number 1 in FIG. 7A reads: "at sign #1 turn left; then, at sign #3 turn right; at sign #6 go straight ahead and at sign #8 turn right; then you are expected to hit item #1234 where you pick four boxes". Memory space is reserved for report information for each assignment, to be keyed-in, upon assignment completion, through operator interface 32 (FIG. 3). FIG. 7B describes the contents of the guidance table 41 of FIG. 4 in said second preferred embodiment, which is simply the sign identification number used in the route directions of FIG. 7A. FIG. 7C relates to the same second preferred embodiment, describing the guidance signal transmitted continuously by portable unit 14 through transmitter 36 (FIG. 3). The guidance signal includes the operator ID, and then the next segment of the assignment, which is a pair of either a sign # +direction (UR/A), or the target ID +assignment detail, all taken from the assignment memory of FIG. 7A. In this case, the portable unit 14 communicates with changeable signs (traffic 15 and target 16), to actuate a visual response corresponding to the signal, and then receives an acknowledge signal from the sign, which causes the message transmitted by the portable unit to change to the consecutive message from the assignment memory (FIG. 7A).

The calculation of the contents of the assignment memory, according to either FIG. 6A or 7A, is preferably made by central computer 11 of FIG. 1 and is downloaded to the portable unit 14 through check-in unit 12. The calculation uses mapping information entered manually to associate target IDs with physical locations, and in FIG. 7A also route selection algorithms, such as those used in many navigation applications, to determine a preferred route for reaching the target. Alternatively, a manual planning of each assignment can be made by a human attendant, and keyed-in into central computer 11.

The reliability of the embodiment described in FIGS. 7A-C is strongly dependent upon a flawless operation of the operator and all signs; a malfunction in a single sign, or a single unawareness to a traffic signal, may break the logical continuity of the route directions, thus leading to unresolvable situations. For this reason, the embodiment of FIGS. 6A-C is preferable and, unless otherwise specified, will be used hereinafter.

FIG. 8 describes a preferred embodiment for a changeable traffic sign, for environments where many operators operate simultaneously. In such a case, using the traffic sign of FIGS. 2A and 4 may be insufficient, as several operators may approach the same traffic sign simultaneously. This embodiment, adapted as an example to the case of FIGS. 6A-C (no transmission capability is needed in the sign) receives guidance signals from portable units 14 through receiver 44. In this case, the transmission of guidance signals (FIG. 6C) should preferably occur with random intervals, so that if signals from two portable units 14 happen to coincide, then the next signals will probably be received without interference. When a proper signal is received by changeable traffic sign 15 of FIG. 8, sign controller 80 assigns it to one of the plurality of displays 82A...82N; if another signal is received before the first one expires, it is displayed on the next available display of 82A...82N, and so on.

FIG. 9 is a flowchart, summarizing the operation of a preferred embodiment of the system according to the present invention; reference is also made to FIG. 1. In block 90 the operator reports at check-in unit 12, where, in block 91, his assignment list is downloaded to his portable unit 14 in the form of a guidance table (e.g. FIG. 6A). A green light 26 on check-in unit 12 indicates that the download process has been completed, and the operator moves into the warehouse area, facing the first changeable sign (block 92), which is a traffic sign (blocks 93, 94). Traffic sign 15 receives a guidance signal (e.g. FIG. 6C) and responds with displaying traffic directions, by matching the direction instruction (from FIG. 6C) with the target location coordinates, according to the guidance table of FIG. 6B. The operator ID included in the guidance signal, is preferably also displayed by traffic sign 15, to assure the operator that the displayed message relates to him. The displayed traffic direction, e.g. in a form of an illuminated arrow, leads the operator to the next changeable sign (block 92), which is either a traffic sign or a target sign (block 93). If it is a traffic sign, the procedure described above repeats; if it is a target sign, at block 95 the sign with the matching target ID responds to the guidance signal (FIG. 6C) by blinking with an eye-catching light and displaying the assignment details, along with the operator ID, taken from the guidance signal of FIG. 6C. The operator then executes the assignment (still in block 95), and, if appropriate, keys-in report information into portable unit 14. If the assignment has been the last assignment, as indicated in the contents of the assignment (e.g. "pick 8 boxes and report at checkout #6"), the operator moves then to a checkout unit 17, where the report information is uploaded from portable unit 14 to central computer 11 via checkout unit 17. If the assignment has not been the last one in the assignment memory (FIG. 6A), the operator approaches the next traffic sign and the procedure described above is executed once again.

Another preferred embodiment will be described herein relating to a guidance system for museum visitors interested in visiting selected exhibits. This embodiment is described below in reference to FIGS. 2A, 2B, 3, 4, 5, 6A-C 10 and 11.

FIG. 10 describes a museum 100 with halls and passageways 104 enabling visitors to access and observe exhibits. A target sign 16 is placed next to each exhibit. Traffic signs 15 are placed at each junction. At each entrance door 101E there is a basket 102E containing portable units 14, which are hand held units (FIG. 3, with receiver 38 and receiver driver 37 eliminated). At each exit door 101X, there is a basket 102X where the visitors return the portable units 14 upon leaving the museum.

Reference is now made to FIG. 11, describing the operation of the system of FIG. 10. In block 110 the visitor receives his portable unit 14 at entrance door 101E. In block 111 the visitor uses operator interface 32 (FIG. 3) to key-in his ID (e.g. name), and a selected list of exhibits, each identified by its location coordinates and exhibit code, as taken from the exhibition catalog or map. This information establishes the contents of registers 31 and 34 of FIG. 3, according to a simplified version of the table of FIG. 6A, where the "assignment details" and "report" columns are eliminated. Then the visitor moves into the museum area, facing the first changeable sign (block 112), which is a traffic sign (blocks 113, 114). Traffic sign 15 receives a guidance signal (FIG. 6C, with the "Assignment Details" eliminated) and responds with displaying traffic directions, by matching the direction instruction (from FIG. 6C) with the target location coordinates, according to the guidance table of FIG.

6B. The visitor ID included in the guidance signal, is preferably also displayed by traffic sign 15, to assure the visitor that the displayed message relates to him. The displayed traffic direction, e.g. in a form of an illuminated arrow, leads the visitor to the next changeable sign (block 112), which is either a traffic sign or a target sign (block 113). If it is a traffic sign, the procedure described above repeats, if it is a target sign, at block 115 the sign with the matching target ID responds to the guidance signal (FIG. 6C) by blinking with an eye-catching light, along with the visitor ID taken from the guidance signal of FIG. 6C. The visitor then observes the exhibit (still in block 95). If the exhibit has been the last one on the list, as indicated on the display, the visitor moves to an exit door 101X, where he returns his portable unit 14 into basket 102X. If the exhibit has not been the last one in the assignment memory (FIG. 6A), the visitor approaches the next traffic sign and the procedure described above is executed once again.

Another variation of a warehouse guidance system will be described in reference to FIGS. 12-15. In this variation, there are no specific entrance or exit gates; instead, guidance and/or reporting information is communicated to and from the portable units throughout the warehouse area via a wireless communication link. This allows frequent, flexible changes of the assignments even during their execution.

FIG. 12 illustrates warehouse 120, where central computer 11 is linked to a plurality of infrared transceivers 127 deployed throughout the warehouse ceiling to communicate with all changeable target signs 126, changeable traffic signs 15 and portable units 124. Such infrared communication links are known in the art and operate commercially. Transmission is usually made by broadcasting coded signals, including address information identifying specific units. Each unit which includes an infrared receiver examines the received signal, and takes into account only messages addressed to it, according to the contents of address register 34 (FIG. 3), 48 (FIGS. 4 and 8) or 51 (FIGS. 5 and 13). Uploading information is made by portable units 14 (FIG. 3) by employing transmitter 36 to communicate with any of the ceiling transceivers 127 (FIG. 12).

FIG. 13 describes a preferred embodiment of the changeable target sign according to the variation of FIG. 12. It is similar to the changeable target sign 16 of FIG. 51 except that storage device 131, including assignment table information (see FIG. 14D), is added.

FIG. 14A describes the contents of the assignment memory register 31 of portable unit 14 (FIG. 3) according to the variation of FIG. 12. The contents is a list of assignments, each identified by a target ID. This list can be downloaded or modified by central computer 11, by communication between the central computer and a selected portable unit through ceiling transceivers 127. The list contains just the target ID, and memory space is reserved for keying-in report information via operator interface 32 (FIG. 3). FIG. 14B describes the contents of guidance table 41 (FIGS. 4 and 8), assigning a direction ("left", "right", "ahead") from each traffic sign 15 to each active target. This information, relating only to active targets (i.e. targets which are associated with current assignments), is computed by central computer 11 and is downloaded selectively to relevant traffic signs 15, according to a reasonable path of the operator; in one case all traffic signs can receive guidance signals to all active targets; in another case, to save communication time between the central computer and the traffic signs, signs which are remote from the path of the operator may be not communicated. FIG. 14C describes the contents of the guidance signal transmitted continuously by portable

unit 14 via transmitter 36. It includes the target ID, to be identified and responded to by traffic signs and the corresponding target sign, and the operator ID to be displayed on the responding signs, to avoid ambiguity with directions aimed at neighboring operators. FIG. 14D describes the contents of assignment table 131 (FIG. 13), which has been added to this variation. This information is downloaded to the target sign by central computer 11 via ceiling transceivers 127 (FIG. 12). When an operator identifies himself by transmitting the guidance signal (FIG. 14C), the assignment details corresponding to this operator, along with a guidance signal and the operator's ID, are displayed on the changeable target sign 126.

FIG. 15 summarizes the operation procedure of the variation of FIG. 12. In block 150 the operator awaits near a sign. As no assignment has been downloaded yet to his portable unit, his portable unit transmits no signal and hence no response is received. In block 151 central computer has selected and computed an assignment for the operator, and accordingly transmits the contents of the assignment memory 31 to the operators portable unit 14 (FIGS. 3 and 14A), the contents of guidance table 41 (FIGS. 41 and 14B) to all relevant traffic signs 15, and the contents of assignment table 131 (FIGS. 13 and 14D) to the selected target sign 126. As a result, portable unit 14 starts transmitting the guidance signal (FIG. 14C). In block 152 the relevant adjacent sign responds to the guidance signal. If it is a traffic sign (block 154) the operator receives traffic directions and travels accordingly to the next sign (block 153). If it is a target sign (block 155) the operator visits the target, executes his assignment according to the details displayed on the target sign, reports as appropriate, and then, according to the details of the assignment, he executes the next assignment (block 152), or completes his task (block 157).

Another application of interest is a parking garage, where an empty space is allocated to each car entering an entrance gate. A portable unit, preloaded with the allocated parking spot details, is handed or automatically dispensed to the driver at an entrance gate. The portable unit interacts with changeable traffic signs to produce driving directions, and then the specific, preassigned parking spot is clearly identified by its changeable target sign. In this case, the communication between the portable unit and the preassigned target sign confirms that the driver has reached his parking space, which is preferably recorded in the assignment memory (FIG. 6A or 7A) as report information, and reported at an exit gate (where the portable unit is also returned) for control purpose.

Another variation of interest relates to a warehouse divided into zones, each zone served by an operator. The portable unit is attached to a cart or a box which accommodates the picked items, thus a pick assignment may be executed by several operators, each moving and loading the cart or box in his turn. As the cart or box is moved and loaded by a zone's operator, the attached portable unit communicates with and triggers the changeable signs in its vicinity in accord to the respective assignment. At the border between two zones, the cart or box, along with the attached portable unit, is left to be moved and loaded by the adjacent zone's operator, and so on, until the assignment is completed.

In still another variation of interest, portable unit 14 (FIG. 3) also includes a display screen controlled by portable units controller 30. When communicating with changeable traffic sign 15 or changeable target sign 16, at least part of the information to be displayed on these changeable signs may be displayed on the portable unit's display, instead of or in

addition to being displayed on the sign. This may aid the operator in reading and distinguishing the information relating to him, and even allow eliminating the display 22 on changeable traffic sign 4 (which actually converts it to a guidance transponder instead of a sign,) or eliminating the screen 24D of the changeable target sign 16, while leaving the light 24L on the sign for better identification of the target.

While the preferred embodiments described above relate principally to warehouse and museum applications, it would be appreciated that the guidance system of the present invention is useful in many other applications.

What is claimed is:

1. A guidance system for guiding a user to selected targets among a plurality of targets located within a defined area, comprising:

a portable unit to be carried by the user, including a memory for storing target information identifying a selected target within said defined area, and a transmitter for transmitting signals identifying the selected target within said defined area;

and at least one changeable guidance sign at a predetermined location within said defined area, said changeable guidance sign including a receiver for receiving signals transmitted by said portable unit, a memory for storing guidance information relating the locations of said plurality of targets with respect to said predetermined location of the changeable guidance sign, and a display for displaying the stored guidance information of the location of a target corresponding to a signal transmitted from said portable unit and received by the changeable guidance sign.

2. The system according to claim 1, wherein there are a plurality of said changeable guidance signs each at one of a plurality of predetermined locations within said defined area.

3. The system according to claim 1, wherein said portable unit memory stores information identifying a plurality of targets to be visited in sequence, and said transmitter transmits signals identifying the respective selected target to be visited in the sequence.

4. The system according to claim 1, wherein said system further comprises a plurality of target devices, one at each of said target locations, each of said target devices including a receiver for receiving target signals transmitted by said portable unit, and a target indicator for indicating that a received target signal identifies the respective target.

5. The system according to claim 4, wherein each of said portable units also transmits its identification to each of the target devices, and each of said target devices also displays the identification of the respective portable unit transmitting a signal received by the target device.

6. The system according to claim 4, wherein each of said target devices is a changeable sign displaying information which changes in response to the target signal received thereby.

7. The system according to claim 1, wherein there are a plurality of said portable units, each to be carried by one of a plurality of users of the guidance system, and wherein each of said portable units transmits its identification to the changeable guidance sign, and said changeable guidance sign also displays the identification of the respective portable unit transmitting a signal received by the changeable guidance sign.

8. The system according to claim 7, wherein said changeable guidance sign display includes a plurality of display devices for simultaneously displaying guidance information of the locations of a plurality of targets for a plurality of portable units, and the identification of the respective portable unit.

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9. The system according to claim 7, wherein the system further comprises a computer for storing said target data identifying the targets within said defined area, and for communicating with said portable units to download into their respective memories the target information identifying selected targets within said defined area.

10. The system according to claim 9, wherein the system further comprises a check-in unit linked to said computer for communicating with said portable units to download into their respective memories the target information identifying the selected targets within said defined area.

11. The system according to claim 9, wherein said system further comprises wireless communication links enabling said computer to communicate with said portable units to download into their respective memories the target information identifying the selected targets within said defined area.

12. The system according to claim 1, wherein said defined area is a warehouse for storing a large number of articles at a plurality of locations, each location representing a target location to which the user carrying a portable unit is to be guided.

13. The system according to claim 1, wherein said defined area is a museum having a large number of exhibits at a plurality of locations, each location representing a target location to which the user carrying a portable unit is to be guided.

14. The system according to 1, wherein said defined area is a parking garage having a large number of parking spaces at a plurality of locations, each location representing a target location to which a user carrying a portable unit is to be guided.

15. A guidance system for guiding a user to a selected target among a plurality of targets located within a defined area, comprising:

a portable unit to be carried by the user, including a memory for storing target information identifying the selected target, and a transmitter for transmitting a target signal representative of the target information;

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a target device adjacent to said selected target, including a receiver for receiving signals transmitting by said portable unit, and a target indicator or indicating that a received signal is said target signal representative of said target information identifying said selected target;

a computer for storing said target information;

and a check-in unit linked to said computer for communicating with said portable unit to download into its memory said target information identifying said selected target;

and a check-in unit linked to said computer for communicating with said portable units to download into its memory said target information identifying said selected target.

16. The system according to claim 15, wherein said check-in unit downloads into the memory of said portable unit target information of a plurality of selected targets within said defined area to which the user carrying the portable unit is to be sequentially guided, and wherein said portable unit include a manual input device to sequentially selected each of said plurality of selected targets.

17. The system of claim 15, wherein said computer also stores assignment information specifying a task to be performed by the user at said selected target, the assignment information is also downloaded into the memory of said portable unit with the respective target information.

18. The system according to claim 17, wherein said assignment information is also displayed on said portable unit.

19. The system according to claim 17, wherein said assignment information is also transmitted by said portable unit and is received and displayed by the respective target devices.

20. The system according to claim 17, wherein each of said portable units includes a manual input device for manually inputting report information relating to the task specified to be performed by said assignment information.

* * * * *

EXHIBIT B

4/10/96

FLOW RACK & SHELVING

- Might have to repl. 2 locations per day
- might ' ' pick from 2 locations per day

SHELVING

48 items in 45 SQ FT 0.9 SQ FT / ITEM

Flow RACK

35 items in 48 SQ FT 1.4 SQ FT / ITEM

- more item facings per SQ. FT.
- have to repl. every day

ORLANDO

70,000 lines x 5.8 pc/line = 406,000 ÷ 38 PC = 10,684 ca/day

ITEMS

- For repl pick every item that's billed w/ order picker more up & down (stops) in an aisle w/ & p more more stops
- Repl more stops when picking
- all Repl. is an "E" - have to get all repl. picked & stocked before start of picking
- every item has less a shelving location
- mult cases to ~~the~~ shelving
- ~~Productivity~~ Productivity rate will go down for repl. picking
- Stocking rate will go down - have to make more stops
- ~~Have~~ Have WFE price for different lengths of shelving

PICKING

- have to turn around w/ HAF - lower productivity
- less flexibility - pickers can't pick ahead of each other
- Bins can't drop till all picks for that order done
- If item won't fit b/c of cube problems - have to start store

Human A-Fame

Repeating Pattern

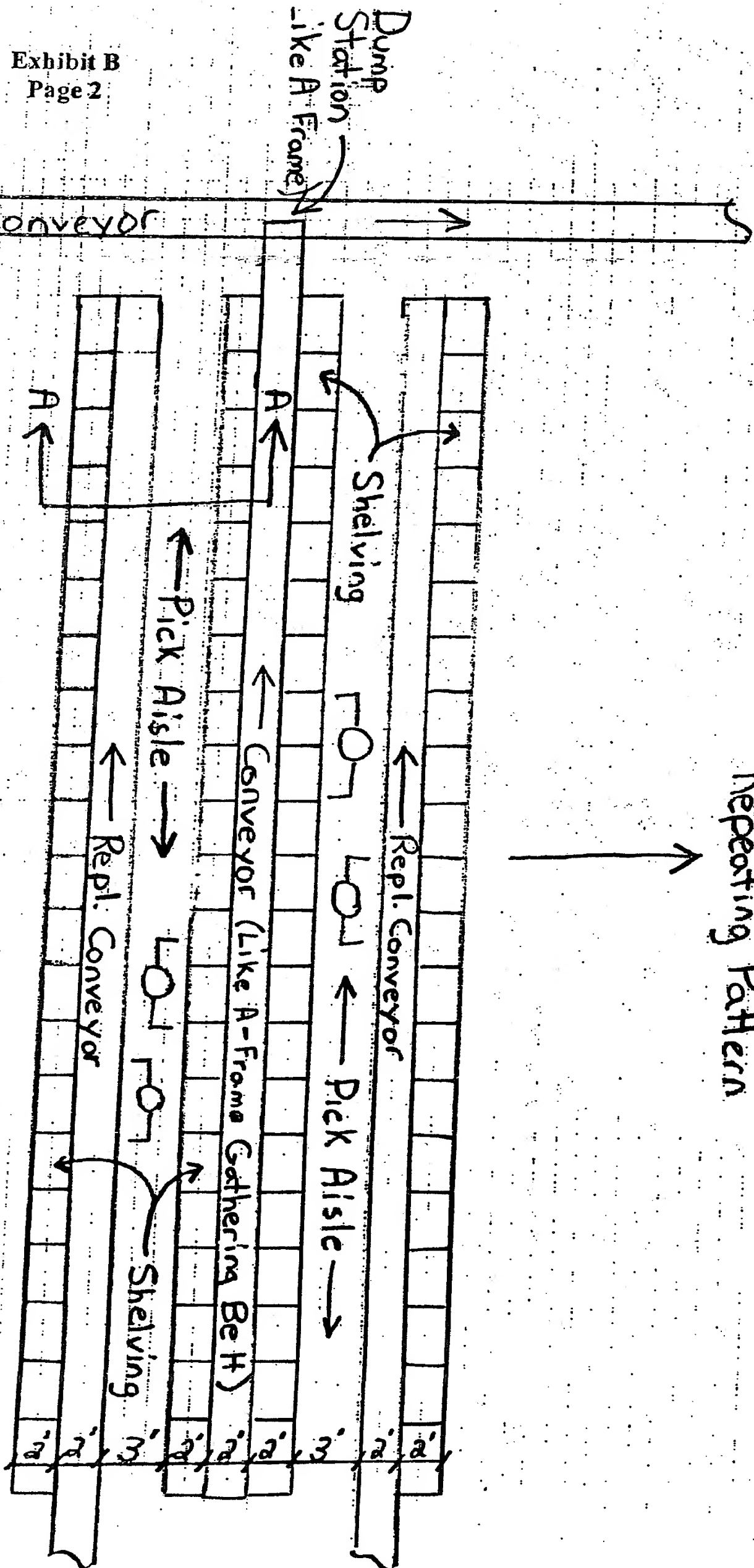
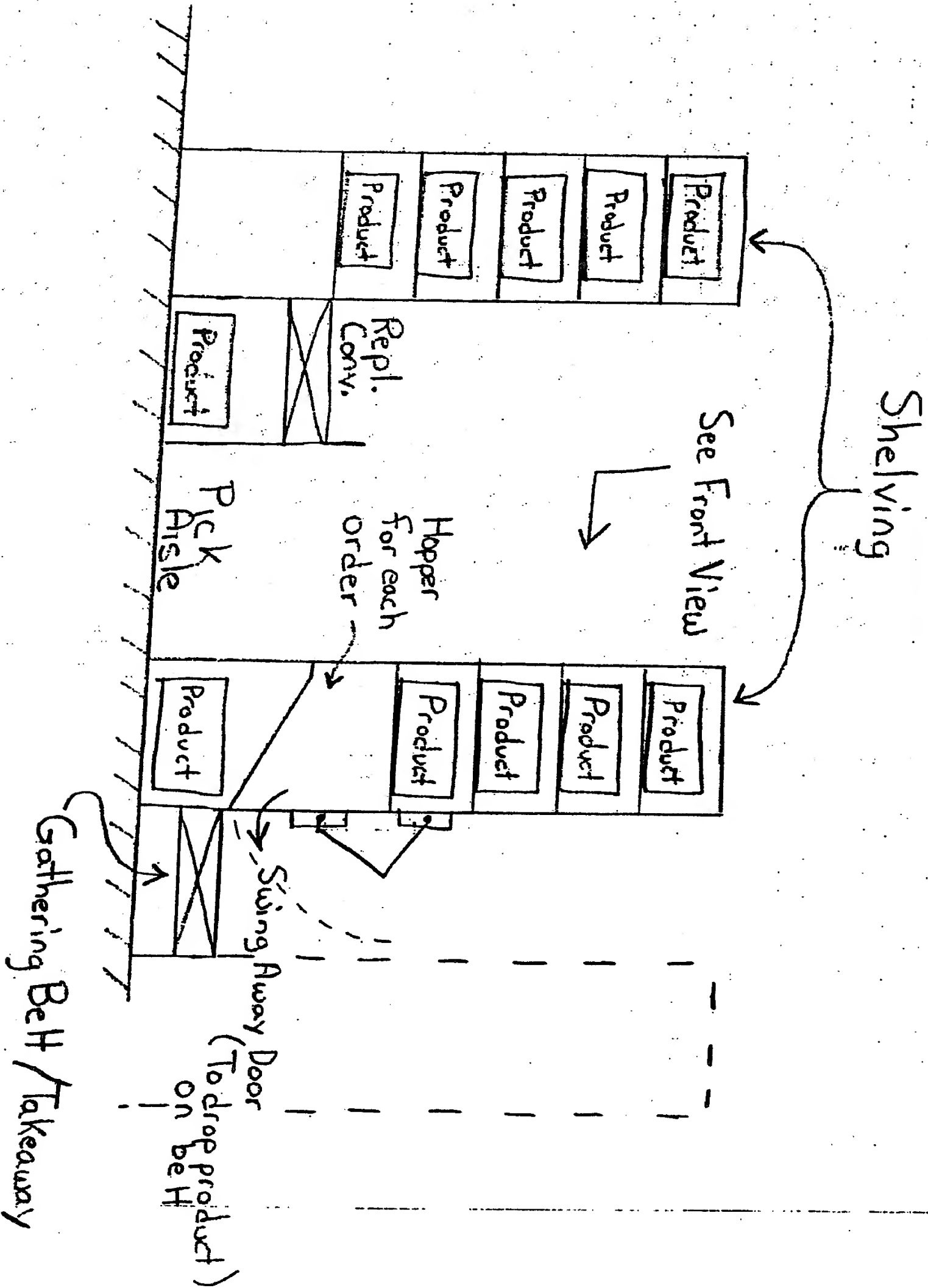


Exhibit B
Page 2

Repeating Pattern

Plan View

Human H-frame



View A-A

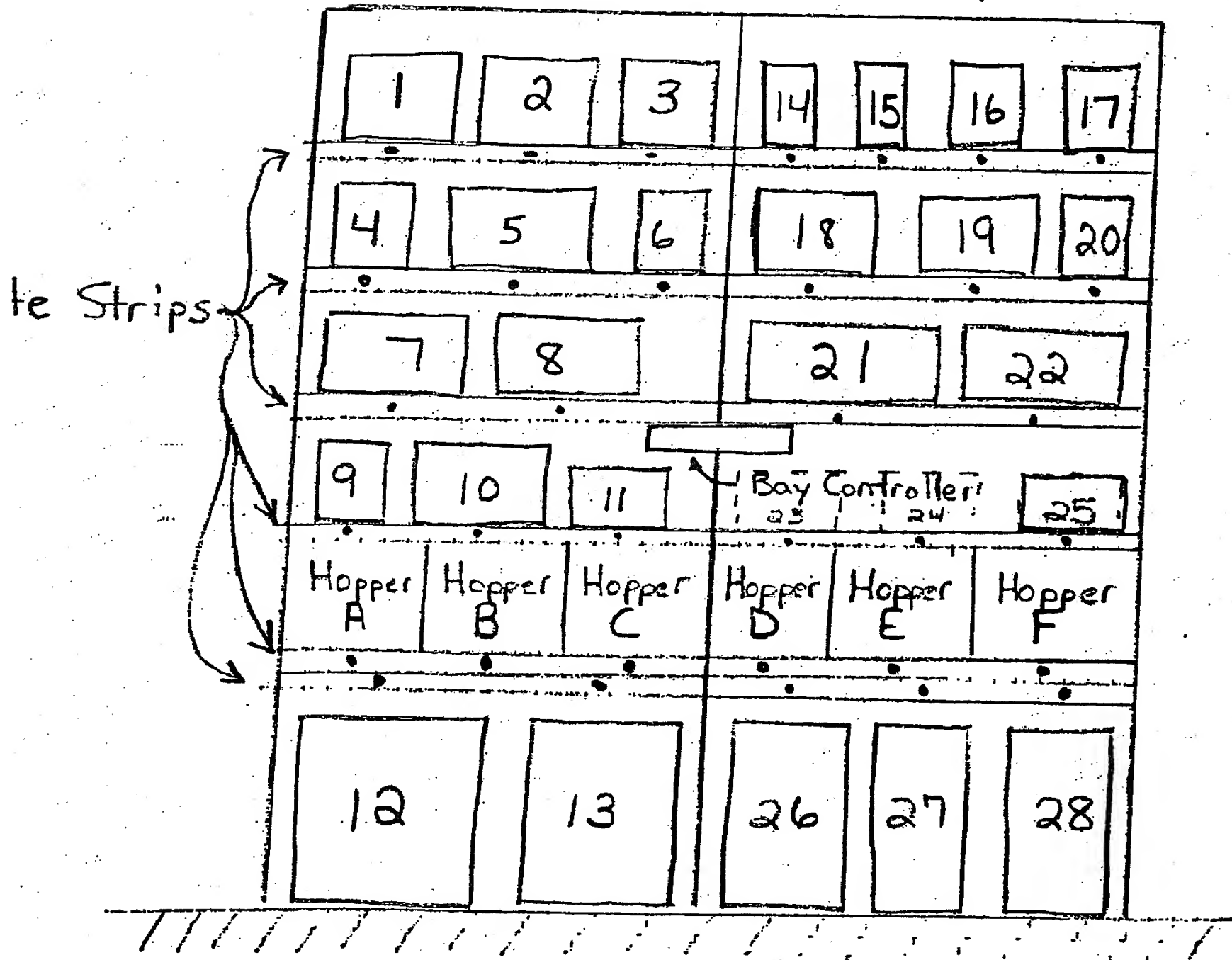
Human A-Frame

Exhibit B

Page 4

Bay 1

Bay 2



Front View

HUMAN A-FRAME

REDACTED

- Kennedy Electric
Toronto

- Internet Response to A-Frame

Contract Co's get breakdown on costs

Pass along 250 L/H (^{Picking} ^{Time})

Human A-Frame = (Picking Time Rate)

Assumed pick - 4 orders at a time

EXHIBIT C

Exhibit C
Page 1

Pick To Bucket Design Criteria

The following criteria are to be used to establish budget pricing for Walgreen's "Pick to Bucket" picking machine.

General Description

The "Pick To Bucket" (PTB) picking machine consists of a series of pick buckets or hoppers that are positioned above a collection or gathering belt. This belt will run in the center of two aisles of flow rack. Split case Pickers will pick product from the flow rack and be directed via Walgreens supplied Pick To Light System to put the product into a hopper indicated by a light that contains the picks for that order in that bay. When all the picks for an order in the entire aisle are complete the hoppers will drop the product onto the collection belt. The collection belt would then dump the product into a shipping tote at the end of aisle dump station.

Functional Requirements

1. The following information is to be used for price estimating purposes. The final requirements will need to be determined.
2. Eight hoppers per bay of flow rack. Each bay is 99" long. *→ per side of flow rack*
3. Hoppers should have a modular design, with the ability to install different size buckets in different bays. For example some bays with 4 hoppers or 6 hoppers per bay mixed with bays of 8 hoppers per bay. *Req 8 & big 6/bay*
4. The area for hoppers should be 32 bays long (264').
5. The dump area will extend past the end of the hopper portion of the machine.
6. The hoppers can be constructed of any material that will provide the necessary function and durability. Plastic, metal or other materials should be considered.
7. The nominal size for the hoppers should be 1' wide in the down aisle direction and 2' deep in the cross aisle direction, final size to be determined.
8. For price estimation the system should have 12 aisles (12 machines), with 32 bays and 8 hoppers per bay. *12 sides*
9. The hopper design shall be safe for pickers to be in close proximity to the hoppers, and provide an area for mounting the Walgreens Pick To Light system (PTL).

512 / line
x 12

6,144
buckets
DC.

Control System

1. Walgreens will determine what buckets the pickers shall pick into and provide an indication to the picker via pick to light.
2. When an order is ready to release onto the collection belt Walgreens will send a list of buckets to be dropped and the order number that the buckets correspond to. The PTB control system will then assign a section of belt to that order. As that section of belt passes hoppers that correspond to that order the hoppers will release product onto the collection belt.
3. The PTB control system will track the belt speed and control the opening and closing of the buckets.
4. The time that the hopper is held open shall be adjustable.
5. When a hopper is closed a signal will be sent to the Walgreens system.
6. The PTB control system will control the indexing of totes in and out of the dump station.
7. Overfilled totes will be detected by the PTB control system and diverted to a correction/audit station.

may have too many buckets

send Flag. with hopper list

8. If directed by the Walgreen's control system the PTB system will divert totes to the audit station for audit or direct a specific tote number to the audit station/error correction.
9. The length of space on the collection belt dedicated to an order shall be adjustable, and the space between orders on the belt shall be adjustable.

- maybe send belt length 1-5 with order #

Dump Station

1. The pick to bucket system will include a dump station that will include the following functions.
2. Totes will be fed to the dump station one at a time from a conveyor system supplied by others. The PTB system will include any conveyor needed to control the indexing of totes. A signal will be sent the external conveyor system to control the flow of totes.
3. The dump station will lift the lid of the tote and automatically apply a shipping label to the top of the tote. - side scan - will send label info to server
4. After the tote has been filled and labeled the lids shall be closed automatically.
5. When required, a signal shall be sent to the external conveyor control system to divert a tote for various reasons, overfilled, audit or other reasons that may be required. Divert included
6. The dump station shall be able to handle a minimum of 400 totes per hour, with a goal of handling 900 totes per hour. 600

7. Verify label at dump station

Product To Be Handled

8. Be able to handle corrugated,
9. sticker device at dump station

1. The product to be picked into the hoppers is any product that Walgreens sells that will fit into the hopper size selected.
2. Examples of product would Health and Beauty aids, OTC drugs, Shampoo, etc.
3. Some product would be excluded due to packaging, such as loose lids, or fragile product, like light bulbs.
4. Consideration in the design should be given to handling the product as gently as possible to handle the greatest number of delicate product possible.
5. The system shall be able to handle round product.

on verify label after apply

9. Conveyor system will feed a tote or box
10. 11 Buckets / order max EST. are. 6 or 7 hopper / bag
How many repacks for PR?

Give us air requirements & price for compressor
we supply compressor

Do we want smaller label?

EXHIBIT D

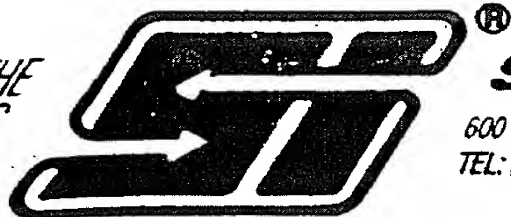
Exhibit D

**Pick-To-Bucket
Order Processing System Proposal
For
Walgreens Corporation
June 30, 1999
SI Proposal No. 00-WDS-013 Rev 1**



Exhibit D

THE
SYSTEMS
INTEGRATORS



SI HANDLING SYSTEMS, INC.

600 KUEBLER ROAD, PO BOX 70, EASTON, PENNSYLVANIA 18044-0070
TEL: (610) 252-7321 FAX: (610) 250-9677

June 30, 1999

Mr. Sean McGonagle
Walgreens
600 Wilmot Road
Deerfield, IL 60015-4616

Subject: Pick-to-Bucket Order Selection System
Reference: SI Proposal 00-WDS-013

Dear Sean:

We are pleased to offer this proposal to design, build and commission a Pick-to-Bucket Order Selection System for Walgreens.

I hope this proposal is satisfactory, and we look forward to working with Walgreens to develop and implement this important new technology.

Please do not hesitate to call me if you have questions.

Sincerely,

Pete Marri

Pete Marri
Key Accounts Manager
Warehouse & Distribution Systems

Exhibit D

CONTENTS

- 1.0** **Scope of Work**
- 2.0** **System Design Criteria**
- 3.0** **System Description**
- 4.0** **Bucket Module Description**
- 5.0** **BRTS Controls**
- 6.0** **Pricing**
- 7.0** **Schedule**
- 8.0** **Standard Terms and Conditions**

A PICK-TO-BUCKET SYSTEM FOR WALGREENS

1.0 Scope of Work

SI proposes that this project be divided into two concurrent phases:

Phase I – Design and prototype

Phase II – System build and implementation

The scope of these phases is as follows:

1.1 Phase I

- Detail design of 16 bucket module
- Build prototype of module - *8-0' module*
- Design bucket tooling
- Test and finalize design - *timing dumps; make sure product dumps*
- Create and deliver Control System Specification
- Deliver firm pricing for Phase II

*- Based on Walgreen's design
- No simulation*

During Phase I we expect to work closely with Walgreens on the system design. To ensure a seamless integration, Walgreens will have final approval of the design during Phase I before beginning Phase II.

1.2 Phase II

- Place order for bucket tooling
- Develop Bucket Release and Tracking Control System (BRTS)
- Build, install, and commission complete pick-to-bucket system

As part of Phase II to complete the system design, installation and commissioning, the following will be provided:

- Mechanical engineering design, drawings, and bills of material, as required.
- Electrical engineering design, schematics, panel layouts, and bills of material, as required.
- Software engineering, i.e., control logic to accomplish conveyor control, release orders onto the collection belt, and transfer the orders into labeled totes.
- Software engineering, setup, and configuration for the host interface, bucket release and order tracking system.
- Supervision, as appropriate.
- Installation and field wiring

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Exhibit D

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Walgreens

1.3 Walgreens Responsibilities

- Totes
- Flow rack
- Lead in and takeaway conveyor, error correction spur
- Pick-to-light
- Order picking and management software
- Pick bucket indicator lights and acknowledgment buttons
- Main power and air drops
- Expenses for Phase I

2.0 System Design Criteria

The system design will consider the following criteria and assumptions :

- Pick-to-bucket System to handle all HABA, OTC drugs, general merchandise, and round products which are stored in the flow rack
 - No poorly packaged or fragile products will be handled
 - System will be modular in design
 - Mechanical design will have 16 buckets per 98" bay of flow rack
 - Nominal bucket size = 1' (down aisle) x 2' (cross aisle)
 - Each aisle will have 32 bays, 16 buckets per bay
 - Product transfer station with tote indexing controls will be supplied
 - Minimum design rate of 400 totes/hour
 - Automatic application of shipping label to side of tote
 - System will be safe for pickers
- When order is ready, Walgreens will send order information, including list of buckets, to the Pick-to-bucket (PTB) control system. The PTB control system will release and collect the order to be deposited in the tote.

3.0 System Description (refer to drawing D-00-WDS-013-1, sheet 3 of 3)

The system consists of a series of pick buckets that are positioned over a collection belt. This belt will run in the center of two isles of flow rack (flow rack provided by Walgreens). Manual Pickers will pick product from the flow rack and place the items into a bucket indicated by a light (light provided by Walgreens). When all the picks for an order in the aisle are complete Walgreens will provide the PTB control system with order information including the buckets that make up the order. The PTB control system will assign a space on the collection belt for the order and the buckets will drop the product onto the assigned section on the flighted belt. The belt will transport the order to the transfer station. The transfer station moves empty totes into position, deposits the order into the tote and indexes the filled tote out of the transfer station.

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Exhibit D

SI Handling Systems, Inc.

Walgreens

4.0 Bucket Module Description (refer to dwg D-00-WDS-013-1, sheets 1,2 of 3)

The system will be designed with nominal 99" long modules to match standard flow rack sections and to allow easy installation and maintenance. Each module will be comprised of a structural frame, pivoting buckets, and bucket release mechanisms. The modules will straddle a standard, cleated, Interlox collection conveyor belt, approximately 21 inches wide. Modules will be pre-assembled and pre-wired, with two rows of 8 buckets each; bucket size will be approximately 1 foot wide by 2 foot deep.

The frame, constructed of rectangular steel tubing, is a simple ladder type structure with 4 vertical support legs and cross members with central spines that support the bucket release mechanisms and cable tray for the electrical wiring. Frame members will be painted with high gloss machine enamel, color per Walgreens specification.

The buckets pivot on shafts attached to the side braces of the frame. Buckets are 5-sided hoppers constructed of molded plastic. When released, the buckets will tilt downward to deposit their contents onto the central collection conveyor. The buckets are manually reset by a lever type handle.

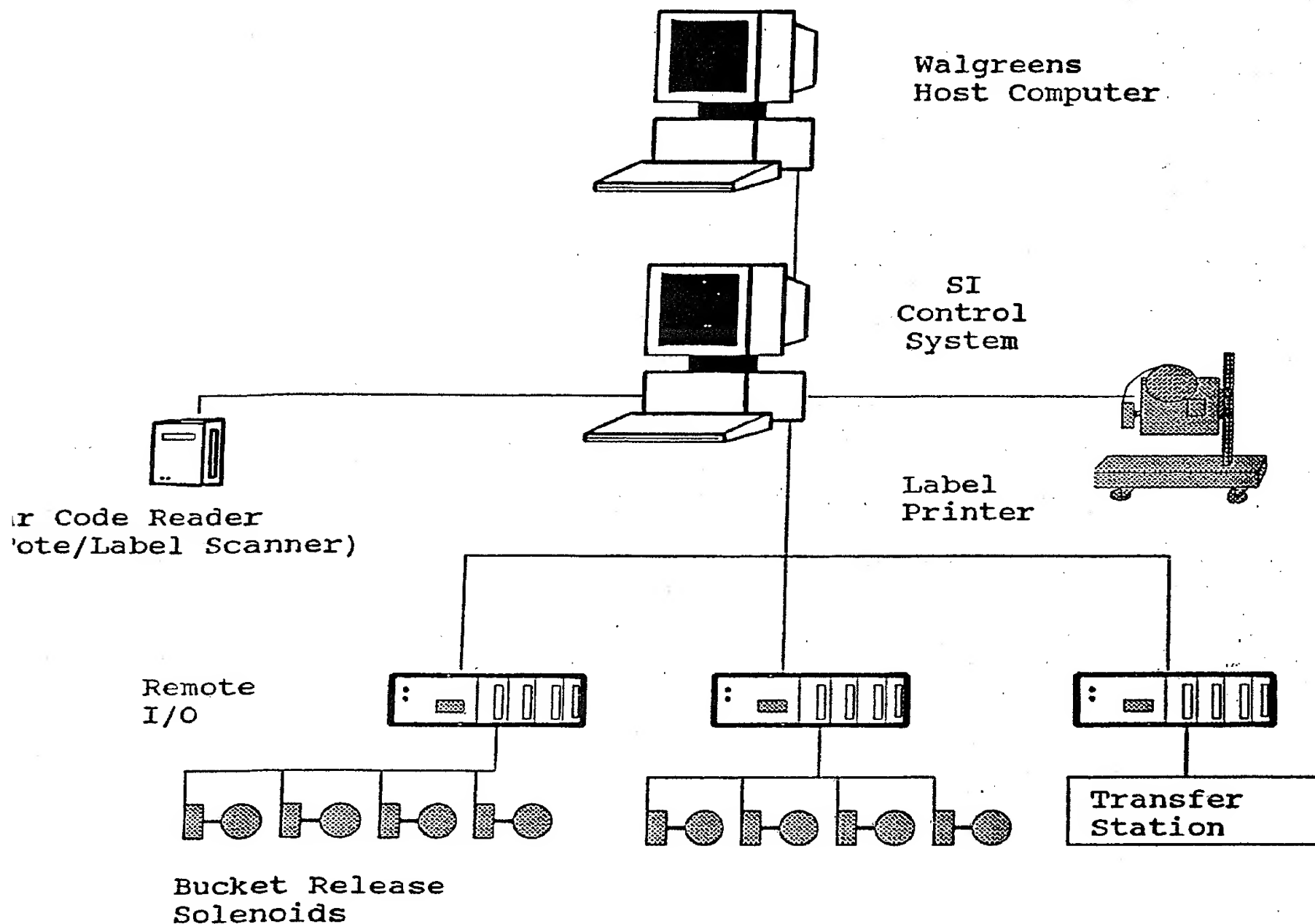
The release mechanisms under each bucket are electric solenoids, actuated by the controls, to drop the bucket. The contents slide out of the bucket, onto a slide pan and then onto the conveyor. This bucket/slide pan interface is designed to provide a soft impact for the bucket and its contents, and also to reduce the level of noise. It also provides sufficient clearance from product on the belt, to prevent jams and interference.

Exhibit D

SI Handling Systems, Inc.

Walgreens

5.0 BRTS Control System



The SI Bucket Release and Tracking System (SI-BRTS), consists of one computer for each aisle, equipped with a printer, monitor, I/O interface card, Host interface card, and software to interface with the customer's Host computer. The Host interface may be either Token Ring or an Ethernet interface. All host/SI-BRTS messages will be communicated via a flat ASCII format using file transfer protocol or Socket to Socket interface over the network.

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Exhibit D

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The Primary functions of the SI-BRTS are to:

- Accept bucket release instructions from the Host
- Provide an operator interface
- Manage the tote tracking, labeling and order tracking
- Generate reports
- Provide data back to Host

The PC Based SI-BRTS Controller is designed to communicate to the conveyor controls, barcode reader, label printer, transfer station and operators. If a database is required, the data will be stored in a Microsoft Access Database. This provides a simple and reliable interface to all of the operators and equipment.

SI-BRTS will receive Order Data with the following information:

1. Unit Number
2. Date
3. Tote Box Number
4. Store ID
5. Address 1
6. Address 2
7. Address 3
8. Address 4
9. ID Character
10. Box Flag
11. ORM-D Flag
12. Order Description
13. Wave Number
14. Source
15. Short or Error Code
16. Order Belt Space
17. List of the Buckets to release

The PC will allocate a space on the collection belt based on the order belt space parameter downloaded from the host or, as an alternate, the number of buckets in the release list.

Option 1:

WAG. record sent down
Order belt space = (Number 1 through 100) X (Space factor)

Option 2:

(90)
Allocated Belt Space = (Number of Buckets) X (Space per Bucket)

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Exhibit D

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The Order Belt Space Factor or Space per bucket will be a configurable parameters stored in the configuration data for the SI-BRTS system. The control system will track the order as it moves toward the transfer station and will print the bar code label for each tote before the tote enters the dump position. The Label Printer will apply the label to the tote and the tote will move forward through the bar code reader. The reader will read the bar code label and the system will verify the tote has a valid bar code and the order being dumped into the tote matches the order on the belt. The tote is moved out of the transfer station and tracked to the exit point of the SI conveyor. If the status indicates the order was short or if an error is detected during the labeling process the tote reject status will be set for the conveyor system to reject the tote.

5.1 Application Description

The application will have security levels for the System Operators, System Supervisors, or System Managers. The menu driven interface allows a supervisor complete access to all products in the database.

In addition to normal operation, the Supervisor and Manager will have the ability to:

- View Order Data
- Update/modify Order information
- Add Orders to the database
- Delete Orders from the system
- Print a report for an order
- List logged transactions and system errors

5.2 Control Hardware Description

The following hardware is provided with the SI-BRTS system:

- (1) PC 400 MHz Pentium II or faster, 128 MB RAM (Backup if required)
- (1) Network Interface card (100mbps)
- (1) 24 port network hub
- (1) Laser Printer

5.3 Software Description

The following software is provided with the SI-BRTS system:

Operating System - Windows NT 4.0
Compiler/Development Environment - Visual Basic 6.0
Communication Software - FTP, Sockets
Database - MS Access
Applications - SI-BRTS, dB utility

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Exhibit D

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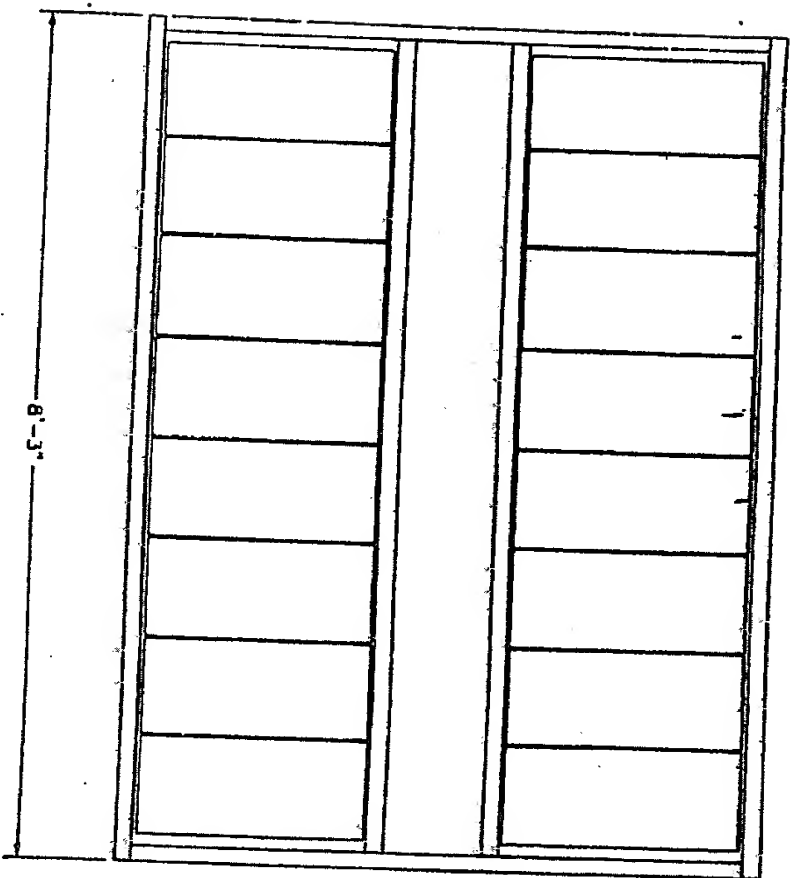
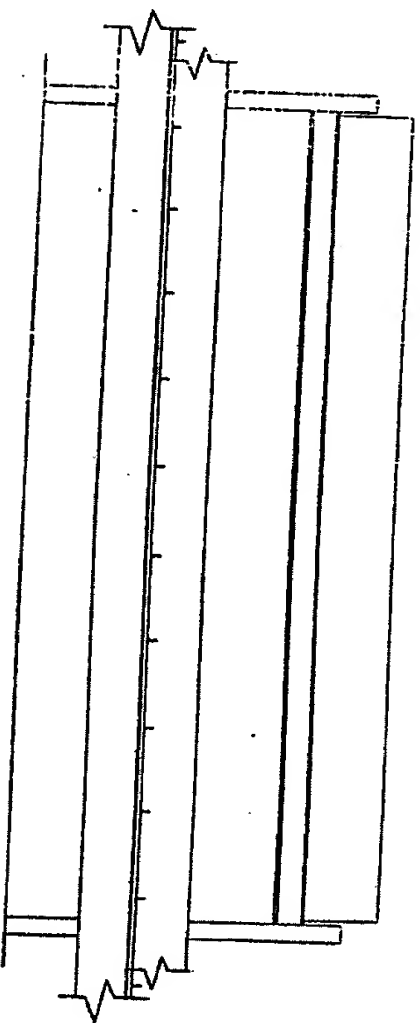
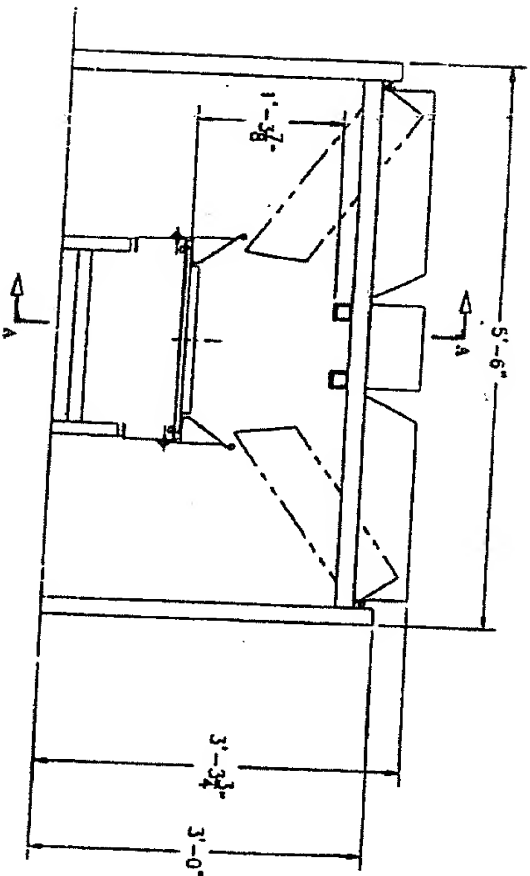
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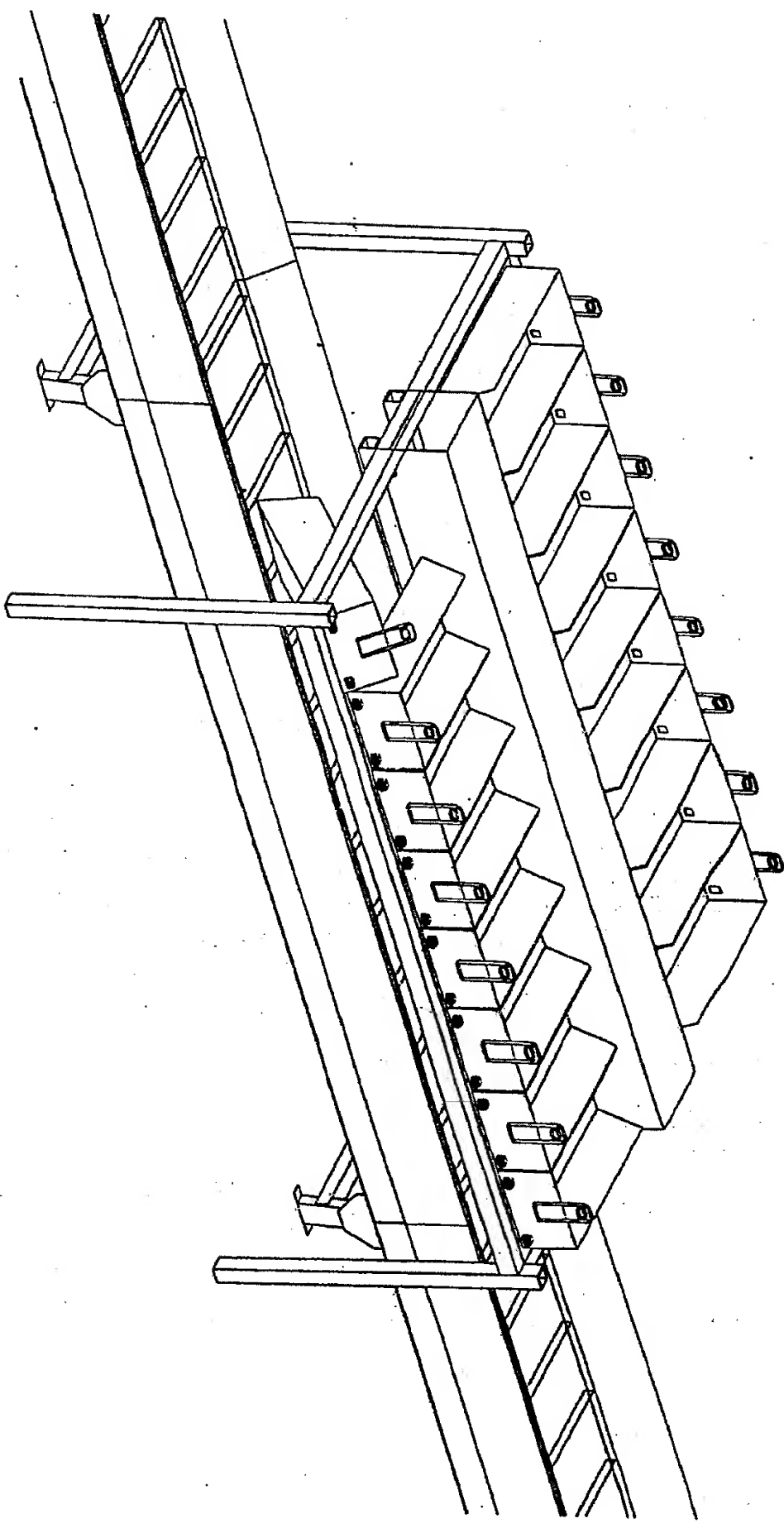


SECTION A-A

ALL DIMENSIONS UNLESS NOTED OTHERWISE
 ARE IN FEET AND INCHES
 1/4" = 1'-0" (PROPORTION)
 TO BE USED FOR CONSTRUCTION
 OF THIS DRAWING AND ALL OTHERS
 THEREON, EXCEPT WHERE SHOWN
 OTHERWISE. SEE SPECIFICATIONS
 FOR DETAILS OF CONSTRUCTION
 AND MATERIALS.

NO.	DESCRIPTION	QTY.	UNIT	PRICE	TOTAL
1	CONCRETE	1	CU YD	1.00	1.00
2	STEEL	1	LB	1.00	1.00
3	BRICK	1	SQ YD	1.00	1.00
4	CEMENT	1	CU YD	1.00	1.00
5	SAND	1	CU YD	1.00	1.00
6	GRAVEL	1	CU YD	1.00	1.00
7	WATER	1	CU YD	1.00	1.00
8	REINFORCING	1	CU YD	1.00	1.00
9	CONCRETE	1	CU YD	1.00	1.00
10	STEEL	1	LB	1.00	1.00
11	BRICK	1	SQ YD	1.00	1.00
12	CEMENT	1	CU YD	1.00	1.00
13	SAND	1	CU YD	1.00	1.00
14	GRAVEL	1	CU YD	1.00	1.00
15	WATER	1	CU YD	1.00	1.00
16	REINFORCING	1	CU YD	1.00	1.00
17	CONCRETE	1	CU YD	1.00	1.00
18	STEEL	1	LB	1.00	1.00
19	BRICK	1	SQ YD	1.00	1.00
20	CEMENT	1	CU YD	1.00	1.00
21	SAND	1	CU YD	1.00	1.00
22	GRAVEL	1	CU YD	1.00	1.00
23	WATER	1	CU YD	1.00	1.00
24	REINFORCING	1	CU YD	1.00	1.00
25	CONCRETE	1	CU YD	1.00	1.00
26	STEEL	1	LB	1.00	1.00
27	BRICK	1	SQ YD	1.00	1.00
28	CEMENT	1	CU YD	1.00	1.00
29	SAND	1	CU YD	1.00	1.00
30	GRAVEL	1	CU YD	1.00	1.00
31	WATER	1	CU YD	1.00	1.00
32	REINFORCING	1	CU YD	1.00	1.00
33	CONCRETE	1	CU YD	1.00	1.00
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43	BRICK	1	SQ YD	1.00	1.00
44	CEMENT	1	CU YD	1.00	1.00
45	SAND	1	CU YD	1.00	1.00
46	GRAVEL	1	CU YD	1.00	1.00
47	WATER	1	CU YD	1.00	1.00
48	REINFORCING	1	CU YD	1.00	1.00
49	CONCRETE	1	CU YD	1.00	1.00
50	STEEL	1	LB	1.00	1.00
51	BRICK	1	SQ YD	1.00	1.00
52	CEMENT	1	CU YD	1.00	1.00
53	SAND	1	CU YD	1.00	1.00
54	GRAVEL	1	CU YD	1.00	1.00
55	WATER	1	CU YD	1.00	1.00
56	REINFORCING	1	CU YD	1.00	1.00
57	CONCRETE	1	CU YD	1.00	1.00
58	STEEL	1	LB	1.00	1.00
59	BRICK	1	SQ YD	1.00	1.00
60	CEMENT	1	CU YD	1.00	1.00
61	SAND	1	CU YD	1.00	1.00
62	GRAVEL	1	CU YD	1.00	1.00
63	WATER	1	CU YD	1.00	1.00
64	REINFORCING	1	CU YD	1.00	1.00
65	CONCRETE	1	CU YD	1.00	1.00
66	STEEL	1	LB	1.00	1.00
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79	WATER	1	CU YD	1.00	1.00
80	REINFORCING	1	CU YD	1.00	1.00
81	CONCRETE	1	CU YD	1.00	1.00
82	STEEL	1	LB	1.00	1.00
83	BRICK	1	SQ YD	1.00	1.00
84	CEMENT	1	CU YD	1.00	1.00
85	SAND	1	CU YD	1.00	1.00
86	GRAVEL	1	CU YD	1.00	1.00
87	WATER	1	CU YD	1.00	1.00
88	REINFORCING	1	CU YD	1.00	1.00
89	CONCRETE	1	CU YD	1.00	1.00
90	STEEL	1	LB	1.00	1.00
91	BRICK	1	SQ YD	1.00	1.00
92	CEMENT	1	CU YD	1.00	1.00
93	SAND	1	CU YD	1.00	1.00
94	GRAVEL	1	CU YD	1.00	1.00
95	WATER	1	CU YD	1.00	1.00
96	REINFORCING	1	CU YD	1.00	1.00
97	CONCRETE	1	CU YD	1.00	1.00
98	STEEL	1	LB	1.00	1.00
99	BRICK	1	SQ YD	1.00	1.00
100	CEMENT	1	CU YD	1.00	1.00

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EXHIBIT E

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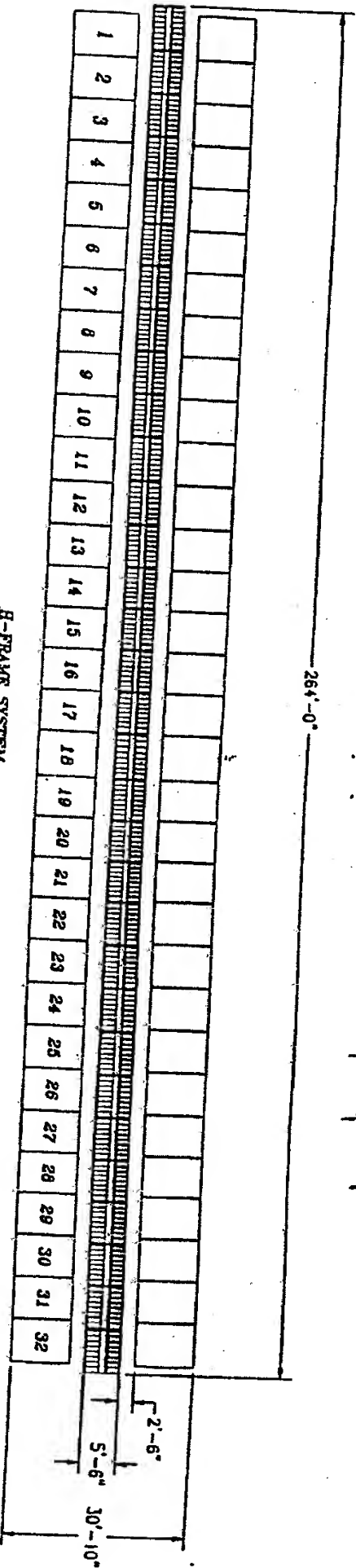
HAF

Claims - Knapp

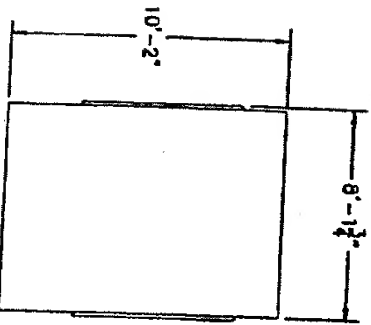
- commissioning system - trays, convs, groups of trays, RF terminals, person assigned to terminal & primary & sec zone
- quitting switch
- indication light
- tray, with downward pivot
- trays above conveyor
- continuous drive for conveyor
- control computer
- plurality of shelves
- conveyor divided into segments
- additional conveyors & HAF's
- checking means
- means for special products

Walgreens Claims

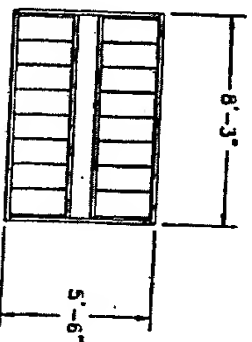
- Use PTL to direct picker (commissioner)
 - faster - no time lag for recognition time
 - more accurate
 - more flexible - add more pickers w/o adding terminals
- ✓ - Pick Arrow Indicator - directs pick to correct area of pick
 - faster - Alpha Name for bucket
- ✓ - Display Bin (Tray) location on rack
 - faster - picker knows when they turn where pick will be, DON'T
- ✓ - No quitting Switch - Pick acknowledged by hitting next within in storage rack - eliminate the step of



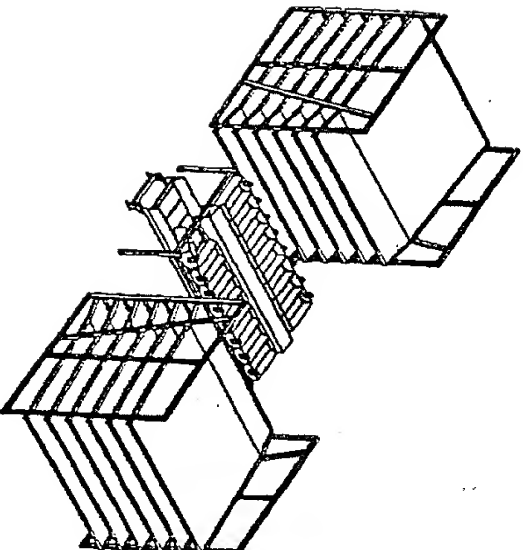
H-FRAME SYSTEM
SCALE 3/16" = 1'-0"



TYP. FLOW-RACK
SCALE 3/16" = 1'-0"



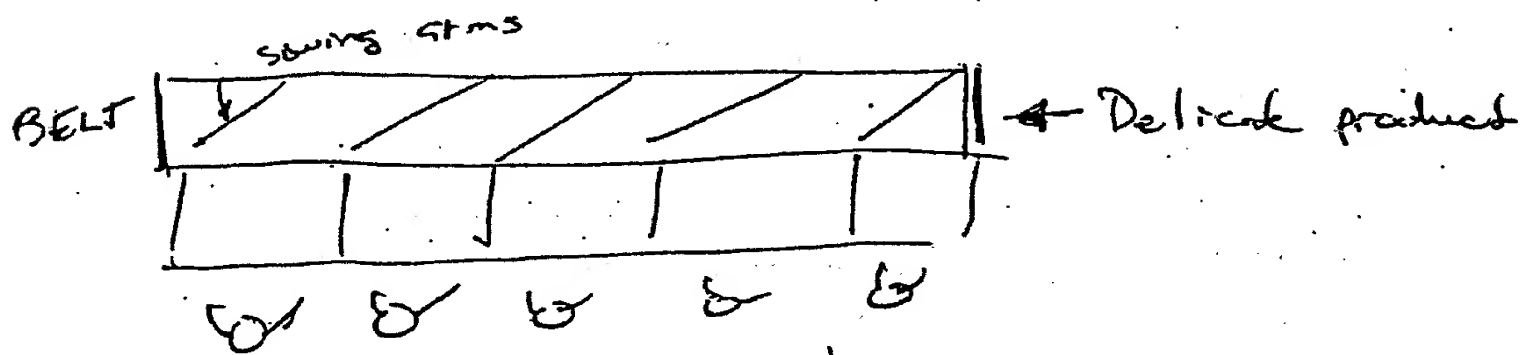
TYP. H-FRAME MODULE
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4/11/00

- ✓ - Special Pack Zone for delicate product - more items
can be picked from machine, less damage,
more better productivity
Don't drop product → Need drawing of pack station
- ✓ - Device that automatically closes lids - saves
manual labor to close lids.
(Don't claim)
- ✓ - Tray Design? In description specified gears for
opening trays, - we use cylinders, Air Billows.
Less expensive
(Don't claim)
- ✓ - Flow Rack ~~is~~ instead of Shelving -
Faster - more items are stored closer to
trays, ~~for~~ less walking time.
Dynamically.
- ✓ - Flexible Zones? Indicators on rack dynamically
assign zones to pickers.



- Cleated Belt (Don't claim)
- round product will convey

Pick portion of trays going way to pick another
portion going back -

... .. 1st

4/11/00

To Do: (2 weeks)

- drawing of Pack stations → Sean & description
- Description of pick method - Ready
- Focus on PTL system with Buckets